



Artcare The Care of Art and
Artefacts in New Zealand

Preventative conservation is the most direct and uncomplicated way of caring for works of art or artefacts.

The revised *Artcare* offers an essential tool-kit of practical advice about keeping New Zealand's treasures safe and avoiding costly restoration.

This book describes many procedures and practices of interest to both private and public collectors.

It includes recent developments in preventative conservation and discusses the safe-keeping and safe handling of works of art and artefacts in a wide range of media.

This cover shows a detail from:

Judy Darragh. Rock and rose bed—The bed you make is the bed you lie in 1989 reconstructed 1996 Plastic flowers, plastic rocks, treated polystyrene.

Gift of Bil Vernon and Denis Cohn and the artist, reconstructed with funds provided by Auckland Art Gallery Toi O Tamaki, 1996.



AUCKLAND
ART
GALLERY

TOI O TĀMAKI

Artcare

The Care of Art and
Artefacts in New Zealand



First published in 1986 by
Northern Regional Conservation Service
Auckland City Art Gallery

This revised and enlarged edition
published in 1998 by
Auckland Art Gallery Toi o Tāmaki
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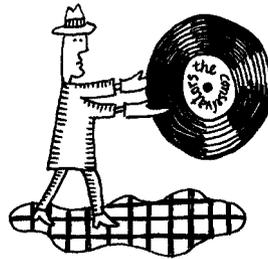
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Preface / Acknowledgments

In 1986 the Auckland Art Gallery, in conjunction with one of its business units, the Northern Regional Conservation Service (NRCS), published the book *Artcare: The Care of Museum and Art Collections in New Zealand*. Such was the immediate success of *Artcare* that it has become long overdue for revising and reprinting. Now it has been accepted as a standard reference within museums throughout the country, an updated *Artcare*, produced under the expert guidance of the Gallery's newly established Conservation Services, seemed more than timely.

The first edition of *Artcare* specifically set out to provide preventive conservation advice to small museums, with particular reference to New Zealand collections and conditions. In building awareness of the primary causes of deterioration and damage to works of art and artefacts, *Artcare* made a very cost-effective contribution to the preservation of New Zealand's cultural material in public holdings. It gave staff, from the paid to the non-paid, an essential tool-kit of practical advice. The revised *Artcare* extends its brief further to encompass the many and varied private collectors who no less look to the safe-keeping of our distributed national collection.

Preventive conservation is the most direct and uncomplicated way of caring for works of art and arte-



facts. Not only are conservation treatments a sometimes expensive path to go down, they do not always lead to the successful reversal of the cumulative effects of deterioration or damage. In addressing the practical needs of those responsible for the care or management of collections, *Artcare* also draws out the caveats which must limit the nature of that care. It makes clear that damage can as much be the product of untrained or ill-advised attempts to conserve or restore works or objects.

The updating of *Artcare* has also been propelled by the many significant advances in conservation science which have led to sometimes quite fundamental shifts in the development of preventive conservation practices and procedures. There are also, of course, many new suppliers and reference materials to hand today, and public and private collectors are demanding current information to ensure that best preventive conservation practices are being applied to the works in their permanent or temporary care.

In introducing this new edition of *Artcare* I would like to especially thank Sarah Hillary, the Gallery's Senior Conservator, for her unerring dedication to this now ongoing project. Sarah has skilfully coordinated the work of many conservators from around the country, to whom the Gallery is no less greatly indebted. Their

shared enthusiasm for the project has resulted in a high level of technical and graphic illustration that will extend the publication's usefulness well beyond public and into private collections, all of which will doubtless serve to take *Artcare*'s reach into the wider Pacific region.

Artcare has been a partnership in many ways. Can I initially thank the individual and institutional members of the New Zealand Professional Conservators' Group for their expert contributions. *Artcare* has been made possible by the no less generous and continuing support of the New Zealand Lottery Grants Board Te Puna Tahua, who have been with the project from its inception. Finally, can I convey the Gallery's thanks to Te Papa National Services and Carter Holt Harvey Distributors, whose partnership support was crucial to our realising the more ambitious content, layout and distribution goals of the new edition.

We are extremely grateful to you all for your collective endeavour to further the preservation of this country's distinctive cultural heritage.

Chris Saines

Director

Auckland Art Gallery Toi o Tāmaki

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Introduction

As in the original publication of *Artcare*, conservation treatments are not discussed because they should be carried out by professional cultural conservators. In addition, disaster prevention and planning was considered beyond the scope of this publication although references can be found in the Reading List. Advice about these and other conservation issues can be sought from conservators working in the major museums and art galleries. Additional information and assistance can be obtained from the following bodies:

***New Zealand Professional Conservators' Group
Pu Manaaki Kahurangi Inc.***

The professional body of conservators in New Zealand. Cultural conservators are specialists with advanced training in the arts, history, technology and materials science who are not just concerned with the restoration of artefacts but are committed to preserving their integrity and to ensuring their long-term survival. The custodians of artefacts are advised to engage the services of full members of this group to carry out conservation treatments. A 1997–8 directory of members is available in libraries and museums. The Secretary of the NZPCG can be contacted c/- PO Box 1467, Wellington.

***The National Preservation Office Te Tari
Tohu Taonga***

Conservation advice for libraries and archives. Located at the National Library of New Zealand, Te Puna Mātauranga o Aotearoa, PO Box 1467, Wellington.

***The Lottery Environment and Heritage Committee,
New Zealand Lottery Grants Board Te Waka Tahua***

Applications for funding for conservation treatments, surveys and preventive conservation projects can be made by charitable organisations to the New Zealand Lottery Grants Board Te Waka Tahua, c/- Department of Internal Affairs, PO Box 805, Wellington.

Te Papa National Services

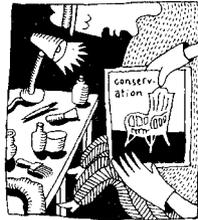
Te Papa National Services is committed to working in partnership with museums and other related cultural agencies to help improve the effectiveness of such agencies throughout New Zealand. For further information contact National Services, Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington.

Auckland Art Gallery Conservation Services

Conservation consultations and treatments for public and private collections. Located at Auckland Art Gallery Toi o Tāmaki, PO Box 5449, Wellesley Street, Auckland.

The Museum Environment

The environment of art and artefacts has a major impact on their preservation. It includes the effect of differing levels of relative humidity and temperature, light, the presence of air pollution, insects and mould. The provision of a suitable environment for cultural artefacts can make the difference between preservation and destruction.



Relative Humidity and Temperature

■ ***Relative Humidity (RH)***— is the amount of water in the air expressed as a percentage of the maximum amount of water the air can hold at the current temperature. The warmer the air the more water it can hold, so relative humidity alters with variations in temperature, decreasing when the air is heated and increasing when it cools. Adverse relative humidity levels and fluctuations in relative humidity can facilitate chemical, mechanical and biological damage to museum objects.

Most chemical degradation processes are accelerated by high relative humidity, since they require the presence of moisture. Examples are the corrosion of metals and the acid degradation of paper and textiles.

Fluctuations in relative humidity cause mechanical damage to both organic and inorganic materials by setting up stress patterns.

Organic materials are hygroscopic. They swell and shrink with changes in relative humidity, absorbing

moisture as it increases and releasing moisture when it decreases. Rapid changes and wide variations can result in cracking and splitting. Wood and ivory are particularly vulnerable. Textiles, paper, leather and parchment are also at risk, especially when stretched or mounted. Hygroscopic materials may also become desiccated and brittle because of excessively low relative humidity. The critical level is below 45% RH.

Inorganic materials may also suffer mechanical damage. Ceramic and stone objects (see also page 47) may crack and flake as the result of the dissolving and recrystallisation of salts caused by fluctuations in relative humidity.

High relative humidity encourages the biological enemies of museum collections. Insects such as silverfish and booklice thrive in damp places. A warm, moist environment is ideal for the propagation of mould and this can cause irreversible damage to museum objects (see also page 5). In order to prevent this, relative humidity should not exceed 65% and temperature should not rise above 23°C.

■ ***Recommended Relative Humidity Levels***—for the preservation of collections of mixed materials, relative humidity should be maintained at a point between 50 and 55%. Daily fluctuations should not exceed $\pm 3\%$, and yearly fluctuations should not exceed $\pm 5\%$.

These requirements presuppose a fairly sophisti-

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cated air-conditioning system which most museums in New Zealand do not possess. However, it is important that they make a serious effort to minimise fluctuations in relative humidity and to prevent it exceeding the limit of 65% or falling below 45%.

The relative humidity level of about 55% recommended for mixed collections is a compromise. Recent debate about indoor environment standards has highlighted the difficulty of defining levels for such a wide variety of materials with differing reactions to the environment. However, conclusions to date reconfirm the importance of preventing large fluctuations in humidity and the need for reliability in humidity control.

Artefacts requiring special conditions may have to be stored and displayed separately from other objects. For example, there are materials that require very low relative humidities, such as certain metal objects in order to prevent corrosion, and alkaline glasses to prevent flaking and 'weeping'.

■ *Monitoring Relative Humidity*—all museums should possess or have ready access to both thermohygrographs and hygrometers (see also page 66) and should regularly monitor storage and display areas. Thermohygrographs record variations in relative humidity over a period, usually a week. They are important for identifying problems when they occur and for determining what causes them. Hygrometers are used for spot checks and are essential for calibrating thermohygrographs. Data loggers (see also page 66) can also be used but require a computer to read the results.

■ *Temperature*—the higher the temperature the faster the rate of chemical degradation of museum objects. Warm temperatures in association with high relative humidity encourage mould growth and insects (see also page 5). However, the main reason for controlling temperature in museums is that changes in temperature result in changes in relative humidity levels.

Temperature should be as constant as possible 24

hours a day and maintained at a level between 18 and 24°C throughout the year. Seasonal fluctuations should be allowed between the two extremes, but daily fluctuations should be kept to $\pm 2^\circ\text{C}$. A cool environment is desirable for the storage of certain objects, particularly certain types of photographs; otherwise the temperature level should be set for human comfort.

■ *Air Conditioning*—with a good air-conditioning system it is possible to control temperature and relative humidity levels and to minimise fluctuations. Some systems, however, cause more problems than they solve. There are a number of considerations. The air-conditioning system must be reliable and be in operation 24 hours a day. If it is not, the relative humidity will alter.

A high degree of air filtration is required to remove particulates. A system employing electrostatic precipitation is undesirable, as the ozone it produces will damage museum objects.

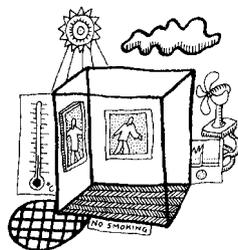
The air-conditioning system should be capable of both humidifying and dehumidifying the incoming air. Because humidity is more important than temperature, it should be controlled first. Fluctuations (seasonal and particularly daily) tend to be more

damaging than constant levels and should be minimised.

Air-conditioning can easily distribute dust, mould spores, insects, smoke, motor fumes and atmospheric pollution throughout the museum. It is therefore important that air circulation should flow from 'clean' areas of the museum into 'dirty' areas, not from areas such as the cart dock, workshop, kitchen or staff-room into the storage and display areas.

Adequate ventilation will prevent stagnant air pockets that are conducive to the growth of mould. The environment inside an air-conditioned building should be monitored regularly with data loggers and/or thermohygrographs.

If the above conditions cannot be met it is better not to have air conditioning.



The Museum Environment

■ *Control of Relative Humidity in a Building without Air Conditioning*—the key to control of relative humidity in a building which does not have an air-conditioning system is knowledge of the interior climate. In most buildings inner rooms are likely to provide a more stable environment, while basements are likely to be excessively damp, and attics too dry. Monitoring with instruments is recommended. Thermohygrographs can be used to find out how conditions alter in the course of a day and at different seasons of the year in various parts of the building.

In order to control the climate of the building the following factors should be taken into account.

Fluctuations of relative humidity are caused by the opening and closing of windows and doors, internal as well as external, switching lamps and heaters on and off, sunlight streaming through windows, heat escaping through windows, leaking waterpipes and roofs and the movement of people through rooms.

Thermal insulation of the building is an excellent expedient for cutting down fluctuations in relative humidity.

Relative humidity rises when water enters a building. It may enter through leaks in roofs, windows and water-pipes, through porous walls or in the form of water vapour from the outside environment. Human beings also bring moisture into a building. This is especially obvious on rainy days. Relative humidity is always higher in the cooler areas of a building. Outside walls, especially those facing south, are usually cold and reduce the temperature of the adjacent air, consequently raising the relative humidity. This is the reason that mould is often seen on these walls.

All methods of moisture access should be attended to. Relative humidity can be reduced in summer by the use of dehumidifiers. In winter it can be reduced with heating, but it is important to ensure good air circulation in order to prevent mould growth. Fans can be used for this purpose. Thermal insulation will reduce the amount of heating required.

It is especially important to prevent the museum environment's becoming excessively dry by overheating. In particular it should be noted that localised areas of desiccated air can be created by heaters and radiators, tungsten lamps and sunlight streaming through windows. Pictures, furniture and items in display cases are highly vulnerable to damage by desiccation.

When an object requires special care it is possible to create a microclimate in a display case or storage container or even in a picture frame by using conditioned silica gel¹ such as Artsorb to control the relative humidity.

(1. See *CCI Technical Bulletin no.10: Silica Gel*, Canadian Conservation Institute, Ottawa 1984)

Light

Many museum objects are susceptible to damage by light, including paintings, works on paper, photographs, textiles, bone, ivory and furniture.

The amount of damage is determined by the intensity and the quality of the light, and the time that the object is exposed. The relationship between damage and exposure, however, is not simply linear, and may be more dramatic at certain stages of deterioration. All light causes damage, but shortwave radiation from the blue end of the spectrum, because of its greater energy, causes more damage than longwave radiation from the red end of the spectrum. Ultraviolet radiation emitted by light sources is more damaging than visible light because of its higher energy.

Because of its quality and intensity, natural daylight in general is more harmful than artificial light sources. Fluorescent lamps, because of the ultraviolet radiation they generally emit, are more damaging than incandescent lamps. The latter, however, may cause damage because of their heat.

Damage by light can be prevented only by storing objects permanently in darkness, but it can be reduced by decreasing the intensity of illumination and by shortening the exposure time.

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■ **Illumination and Exposure Time**—light intensity is measured in units of lux. Exposure time is measured in lux hours. It is recommended that exposure time for museum objects extremely sensitive to light, including works on paper, photographs and textiles, should not exceed 150,000 lux hours per year. This means that for objects on display 365 days of the year the level of incident light should not exceed 50 lux, and light should be excluded outside viewing hours (a maximum of 8 hours per day). If it is considered necessary to illuminate objects at more than 50 lux, then display time should be reduced proportionately. For example, if the illumination is four times higher (200 lux) then the object should be displayed for only three months a year and stored in darkness for the other nine months. Another possibility is to exclude light from the objects at all times when they are not being viewed, for example with curtains, covers or time switches.

Illumination for other light-sensitive objects on permanent display should not exceed 200 lux.

Although objects not affected by light may be illuminated at higher levels, it is not usually necessary to exceed 300 lux.

■ **Ultraviolet**—as much ultraviolet radiation as possible should be removed (ideally all in excess of 50 microwatts per lumen) by passing the light before it reaches the works through a material transparent to visible light but opaque to ultraviolet. Glass absorbs the most damaging wavelengths of ultraviolet (below 300–310 nanometers), but the radiation between 300–400 nanometers should also be excluded to avoid damage.

New varieties of glass and acrylic sheeting will absorb a great deal of the ultraviolet light but beware of developing a false sense of security when using these products. Most allow some ultraviolet to get through as well as the other damaging components of light (other wavelengths, especially infrared). Although these products are useful for delicate objects, light levels should still be controlled within recommended levels.

Plastic films (see also page 64) can be applied to windows to reduce ultraviolet levels as well as the other components of light which produce glare and heat. Manufacturers' claims, however, should be tested with a light meter. These can be useful for homes, historic houses and other buildings where complete blocking of natural light is not appropriate.

In the past most fluorescent lamps required ultraviolet filters, but new varieties are available that emit much lower levels of ultraviolet radiation (eg Philips 94). Ultraviolet sleeves can be installed to reduce the ultraviolet to an acceptable level. It is also important that the ballasts of fluorescent lights be mounted

outside a display case since they emit heat. Quartz halogen lamps emit high levels of ultraviolet but are available with an ultraviolet filter. The MR-16 variety have dichroic reflectors that scatter the light and reduce the heat. Tungsten incandescent lamps emit only a very small quantity of ultraviolet but generate a great deal of heat which can be a problem in enclosed spaces or if the light is too close to the artefacts. As the motor of fibre optic lighting emits heat, it must be separated from the light.

Recommended Light Levels for Objects on Permanent Display

Oil, tempera and acrylic paintings, undyed leather, lacquers; wood, horn, bone and ivory (where surface colour is important)

..... 200 lux

Works on paper, photographs, parchment, miniatures, textiles, costumes, plant fibres, fur, feathers, natural history specimens

..... 50 lux

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Sunlight (because of its intensity and infrared radiation as well as ultraviolet) should neither be allowed to fall directly on to works of art nor be reflected on to them from a mirrored surface. White paint (titanium, zinc and lead) is a fairly good ultraviolet absorber and, in some cases, it may be possible to solve the ultraviolet problem by ensuring that all light entering a room is reflected at least once from a white wall.

■ **Light Measurement**—meters are available for measuring visible light and ultraviolet radiation. All museums should either possess or have ready access to these meters.

Air Pollution

Dust is damaging to museum objects. It makes them unsightly, can cause permanent soiling, and contains microscopic particles of grit which cut and abrade materials. It attracts water, encouraging chemical action and mould growth. Dust also contains substances such as salt which promote chemical degradation of materials.

Smoking and the general use of aerosols should not be permitted in display or storage areas because tobacco smoke and aerosol substances form deposits on the surface of objects which are difficult or impossible to remove.

Atmospheric pollution is also harmful to museum artefacts. Large cities tend to have high levels of carbon monoxide and sulphur dioxide. Thermal areas produce large amounts of hydrogen sulphide. Associated with high relative humidity, these gases become destructive acids.

Atmospheric pollutants can also be produced inside the museum by the emission of gases from certain construction materials, textiles, adhesives and paint, and in special cases from the artefacts themselves. It is advisable to check with a conservator before choosing materials for display or storage. For example, new concrete walls produce alkaline aerosol particles which can discolour dyes and pigments and weaken silk.

The urea-formaldehyde foam used as thermal insulation and the formaldehyde resins used in plywood,

particle board and other building materials produce formaldehyde gases which cause embrittlement and corrosion in many artefacts and are toxic to humans. Certain woods give off acetic, formic and tannic acids which can cause considerable damage to lead objects. Adhesives such as PVA emulsions have similar effects.

Sulphides are emitted from certain rubbers, paints and finished textiles causing the tarnishing of silver and the discolouration of photographs and pigments.

Cellulose nitrate preparations were among the first plastics invented. They include photographic films, imitation silk, adhesives, and impregnated fabrics. Cellulose nitrate continuously emits acidic vapours as it ages which can cause the disintegration of neighbouring objects.

Insects and Mould

These cause a significant amount of damage to New Zealand collections of cultural artefacts every year. The mild, humid climate found in many buildings which lack air conditioning provides a perfect environment for their propagation. The damage caused ranges from minor losses and staining to virtual destruction. Organic materials are affected most. Some common insect pests are:

□ Silverfish (*Thysanura: Lepismatidae*)—feed mainly on starchy substances but will eat many other materials including cellulose, provided there is some starch content present, eg paper, cardboard, cotton and linen.

□ Clothes Moths (*Lepidoptera: Tineidae*)—adult clothes moths do not feed and it is the larvae which cause the damage. The larvae will feed on almost anything containing proteinaceous material and may damage almost any other adjacent substance to reach it. Proteinaceous materials include animal products such as hair, horn, bone, claws, fur, wool, silk and feathers and the exoskeletons of insects.

□ Cockroaches (*Orthoptera: Blattellidae/Blattidae*)—will feed on a variety of materials, including books, leather, sizing and glues. Mainly, though, they are ‘food’ eaters and damage materials through soiling.

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□ Booklice (*Psocoptera: Liposcelidae*)—also called dust lice. These minute insects feed on moulds, paper fibres, glue size and dried insects. Booklice are dependent on a relatively high humidity and are absent from dry, well ventilated buildings. Although they do very little damage themselves they provide a warning that conditions may be unsatisfactory.

□ Beetles (*Coleoptera*)—these can be divided into two groups:

Beetles that damage wood, such as the common house borer (*Anobium punctatum*). These are small, brownish beetles up to 5 mm long and are easily recognised by their hooded heads. They are active from November to March each year and attack all woods. Their eggs are laid in crevices and old borer-holes, hatching into small grubs in about three weeks. They will bore in the timber for three to four years before emerging as adults; thus the first signs of borer attack will be the appearance of holes in the artefact as the adult insects leave to infest other timber.

Beetles that cause damage to other materials such as textiles, furs, fabrics, hides, feathers, dried insects, plants etc, such as the larvae of the carpet beetle (*Dermestidae*).

□ Termite (*Isoptera: Rhinotermitidae*)—the New Zealand drywood termite has the potential to infest museum objects, attacking the end-grain surfaces of damp wood.

□ House-fly (*Diptera: Muscidae*)—flyspots are acidic and become insoluble over time, leaving permanent stains.

Pest Control

□ Keep Storage and Display Areas Clean—reduce the pest attractants. Food should not be consumed in storage areas and is also not recommended in the display galleries as it encourages pests. Regular cleaning of all areas is advisable. Organise or discard clutter. Filters on air-conditioning systems and/or insect screens will prevent flying insects entering the area. When new objects

are brought into the building they should not be taken directly into a storage or display area. They should be inspected in a separate room. If insects or eggs are found they should be removed if possible; if not, they will need further treatment and a conservator should be contacted for advice.

□ Protect Individual Objects in Storage from Infestation—objects made of vulnerable materials such as feathers, textiles, furs, etc, should be given extra protection in storage. Wrapping in acid-free tissue and storage in boxes is an advantage.

□ Regular Inspections of the Collection—these are extremely important to check for any signs of infestation. Insect traps can be used. Collect specimens and place in alcohol or freeze for identification purposes. Isolate infested objects from other items in the collection.

□ Treatment—residual insecticides such as Permethrin or Cislil (permethrin in aerosol form) can be sprayed around entranceways and the bases of storage and display units, to halt the movement of crawling insects. Insecticides must not be sprayed directly on to objects themselves and must be re-applied every 3–4 months. Because they work by killing only insects that crawl across the sprayed surface, they are reasonably safe to use, although all pest control products should be considered potentially harmful to health.

Because fumigants are damaging to both humans and the environment, many have been banned or their use restricted. Consequently a number of alternatives are being developed that are safe and effective which include freezing, anoxic treatment (using oxygen scavengers such as Ageless, or carbon dioxide) and the use of specific fumigants in controlled conditions.

Please contact a conservator for advice on a suitable treatment.

Mould

Some types of mould include:

□ Mildew—is the most common fungus to attack textiles and it appears as small black spots. Mildew allowed

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to remain on natural fibres will stain, gradually weaken the fibres and create holes.

- **Dry Rot**—the surfaces of wooden items can be stained by mould, while wood-rotting fungi such as dry rot severely damage the structure. Wood decay such as dry rot and wet rot will only develop where wood is constantly damp or wet.

- **Mould on Paint**—the supports of paintings are susceptible to fungal attack but mould can also grow on the paint layers. This usually begins with the mould growing on the support or on surface dust. Either way, it eventually eats into the paint layer as well and can leave permanent stains.

- **Foxing**—the brown spot stains on paper called ‘foxing’ require the combination of metallic impurities in the paper and micro-organisms for their development.

Mould Control

- **Keep Storage and Display Areas Clean**—dust contains dormant mould spores and will sustain their growth under favourable conditions.

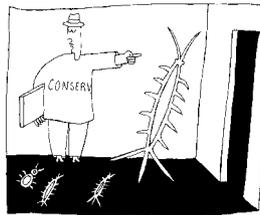
- **Keep Relative Humidity Below 65%**—air conditioning should operate 24 hours a day. If there is no air conditioning, storage should be in a drier part of the

building. Do not store works of art or artefacts in damp basements. Avoid hanging pictures on outside walls that are not insulated or on walls that feel cold or damp. Do not frame pictures in direct contact with glazing. If items are stored or displayed in closed or airtight containers, the internal relative humidity should be considered. It may be advisable to control it with silica gel.

- **Maintain Good Air Circulation**—good air circulation reduces the likelihood of mould growth. Do not store works of art or artefacts directly on the floor. Raise them up on supports to permit the air to circulate. Circulation of air behind pictures may be assisted by attaching pieces of cork, rubber, plastic or cardboard to the lower corners of frames so that they are held away from the walls. Do not store or display items in closed containers or rooms without provision for air circulation or dehumidification.

- **Regular Inspections of the Collection**—regular checks may mean that a problem is caught before it gets too bad. Photographic records of condition mean that any changes can be quickly and accurately identified.

- **Avoid the Use of Fungicides**—they should be avoided if possible as there is a risk of damage both to the objects and to human health. If there is a mould infestation consult a conservator for advice.



Paper: Works of Art / Books / Archival Collections

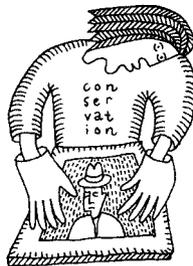
Paper is thought to have been first made in China around AD 105, and since that time has been commonly used as the support for images in a variety of media. Until the 19th century most Western papers were made from linen rags. However, by the end of the 19th century the vast majority of paper was derived from plant sources such as wood. In the East plant fibres from the inner bark of native shrubs have, for many centuries, formed the basis of papermaking. As a general rule, during the 20th century, woodpulp is found as the stock fibre of papers worldwide.

When paper deteriorates it may become discoloured and develop brown spot stains, known as foxing. Foxing requires metallic impurities in the paper and microorganisms for its development. In advanced stages of deterioration the paper can become increasingly brittle.

Deterioration of paper is promoted through the combination of a number of internal and external factors.

Internal Sources of Deterioration

■ **Acidity**—the correct pH level is vital to the stability of any paper. The pH scale measures the concentration of hydrogen ions in a material, thus giving an indication of the level of acidity or alkalinity. The scale is measured from 0–14, with pH 7 recording the neutral point. Below pH 7 a substance is regarded as being acidic and above pH 7 as being alkaline.



A high level of acidity is generally regarded as the single most damaging factor in the deterioration of works of art on paper. Chemically, paper is composed of cellulose, a long-chain polymer of carbon, hydrogen and oxygen. Pure forms of cellulose are derived from linen and cotton. Other fibre sources, such as unrefined woodpulp, have a high lignin content and produce less stable papers which have a tendency to become inherently acidic. Some manufacturing processes compound the problem by utilising chemicals such as bleaches and acidic sizes which result in acidic residues being left in the paper.

Sometimes the paper becomes acidic as a result of the media which have been applied to it. Media such as iron gall inks and pigments such as those green and blue pigments which are based on copper can catalyse the degradation of cellulose, causing localised areas of images to fragment through embrittlement.

External Sources of Deterioration

■ **Acidity**—paper is also subject to degradation subsequent to the manufacturing process. Acidity is high on the list of external sources of damage, but in the form of migratory acidity. When works of art on paper are mounted with poor quality boards and adhesives, acidic components will migrate into the paper support causing discoloration, staining and embrittlement. Pigments are

also subject to damage through shifts in pH. For example the blue pigment, Ultramarine, can be decolorised by high levels of acidity.

Another contributing factor to the level of acidity in works of art on paper is pollution, particularly in urban environments, where sulphur dioxide from the combustion of fossil fuels and particulate dirt are perhaps the worst offenders.

■ *Light*—all light causes irreversible damage to works of art on paper. Natural light contains high levels of ultraviolet radiation, the most active and therefore the most damaging component of the spectrum. Tungsten and fluorescent light sources are also damaging. Light catalyses the rate of deterioration of all works on paper in several ways. Papers, particularly those with a wood-pulp content or acidic residues, will yellow and become brittle in a relatively short time.

Pigments and inks will commonly fade. Those pigments which are most susceptible are of organic origin, pinks such as Madder or blues such as Indigo, both derived from plants and regularly used in watercolour. Prints and drawings are also subject to light damage. Some Japanese prints use traditional pigments, such as Aigami blue from the dayflower, which can fade in a matter of days on exposure to bright light. Many 19th and early 20th century posters make use of extremely fugitive aniline dyes. The combination of paper darkening and pigments fading on exposure to light can alter the tonal values of a work of art on paper beyond recognition.

Light damage is cumulative and irreversible. Works of art on paper should be displayed on a rotation basis (3 months maximum on average) to alleviate the effects of light damage (see also page 4). For display, a light level of 50 lux is recommended, using filters on light sources and windows to reduce the ultraviolet component of the light to negligible levels.

■ *Temperature and Relative Humidity*—high levels of humidity and temperature increase the rate of any chemical reaction and thus accelerate the acid-induced deteri-

oration of paper (see also page 1). Foxing and mould growth will flourish, often staining and digesting both paper and media. The paper support will expand and contract in direct response to the amount of moisture in the air. Fluctuations in temperature and humidity can generate a cycle of expansion and contraction causing flaking and cracking of the media and cockling of the paper support. Conversely, in constantly low levels of humidity, paper and media can become desiccated.

Works of art on paper should be displayed and stored in temperatures of 20°C ±2°C, and ideally in a relative humidity of 50–55%. Dramatic fluctuations in temperature and humidity should be avoided. Works of art on paper should not be hung near heat sources or on outside walls.

■ *Insects and Rodents*—paper is undoubtedly an attractive food source for insects and rodents. The problem is compounded if the environment is not cleaned on a regular basis. Insects (see also page 5) and rodents cause a multitude of unsightly mechanical damages, chewing through paper supports, sizing agents, gum binders and wooden stretchers with great enthusiasm. Good house-keeping procedures will keep most pests at bay.

■ *Careless Handling and Intervention*—much of the damage to works of art on paper has come about through inappropriate repairs and rough handling. Paper is easily torn, punctured, creased and stained. The image surface is susceptible to abrasion. When used for repair, pressure-sensitive tapes, animal glue, rubber cement and other non-archival adhesives will cause irreversible damage such as staining. Most commercially available fixatives change the inherently friable nature of the chalky pigments they are commonly used to protect, engendering texture and colour changes in the media.

Works of Art on Paper

Handling unframed works of art on paper—unframed works of art on paper should be handled with the greatest care, always with clean, dry hands, and preferably with cotton gloves to minimise soiling to the mounts.

As a precautionary measure, ensure rules outlining handling procedures are displayed in any areas such as print and study rooms where works are handled on a regular basis. Make certain that members of staff and visitors are aware of these rules.

Food, drink and ink pens should not be allowed in these areas. Pencils are preferable for note-taking.

Avoid touching the work directly, as this may cause damage through transfer of dirt and grease from the fingers. The paper support is often more brittle and degraded on the edges, therefore great care must be taken when attempting to lift these areas. A piece of thin board or paper gently slipped under the work will usually facilitate lifting the sheet to view the verso (see paper fingers on page 23).

Unframed works should not be stacked in large piles (see also page 15). Mounted works should not be pulled from the middle of stacks as this can cause mechanical damage such as abrasion and cracking or tearing of the support. Interleave mounted works with acid-free tissue to reduce the possibility of mechanical damage and to protect the work and its mount from surface dirt transfer when stacked with other works.

Always move unframed, mounted works on paper one at a time. To move a mounted work, lift it by the mount using both hands, keeping it horizontal and face up, with the image the right way up. Place it on a clean, clear surface.

Mounts should always be opened from the lower right-hand corner or edge, never by the inner window. All mounts should open in the same manner for safe, consistent handling.

If an unframed work on paper is to be viewed, desk easels and lipped shelves are safer than leaving a work flat on a table. It is preferable to remove jewellery before handling unframed works on paper.

Conservation mounting—of works of art on paper not only provides physical support and an acid-free environment for the work, but also allows for a consistent

method of display. The window board or mat, as it is often called, prevents contact between the image and the glazing in the frame, and serves to separate unframed works stored in solander boxes. The process of mounting is sometimes described as matting.

Accession numbers and other information may be recorded on the mount. Mount boards suitable for conservation-standard mounting include Rag or Museum board which is usually composed of 100% cotton fibre with a neutral pH; Buffered Rag or Museum board which is 100% cotton fibre with an alkaline reserve and a pH of 7 or more; and Conservation board which is made from chemically purified woodpulp, has an alkaline reserve and a pH upwards of 7. As coloured mount boards can fade dramatically, white or ivory 4-ply mount boards are recommended.

Institutions often make use of standard mounts that fit into standard frames, allowing works of art on paper displays to be rotated on a regular basis. The size of the mount may be predetermined by an existing frame. Works of art on paper should never be trimmed or folded to fit into a mount or frame. The mount should be cut to reveal the image and any other additional information, such as the plate mark, signature and title of the work. To create a balanced visual effect, the mount is usually cut with equal top and side margins and a slightly larger margin on the lower edge.

Preparing the Mount

■ *Materials*

Two pieces of 4-ply mount board cut to the required size
Mount cutter

Gummed linen tape

Weights

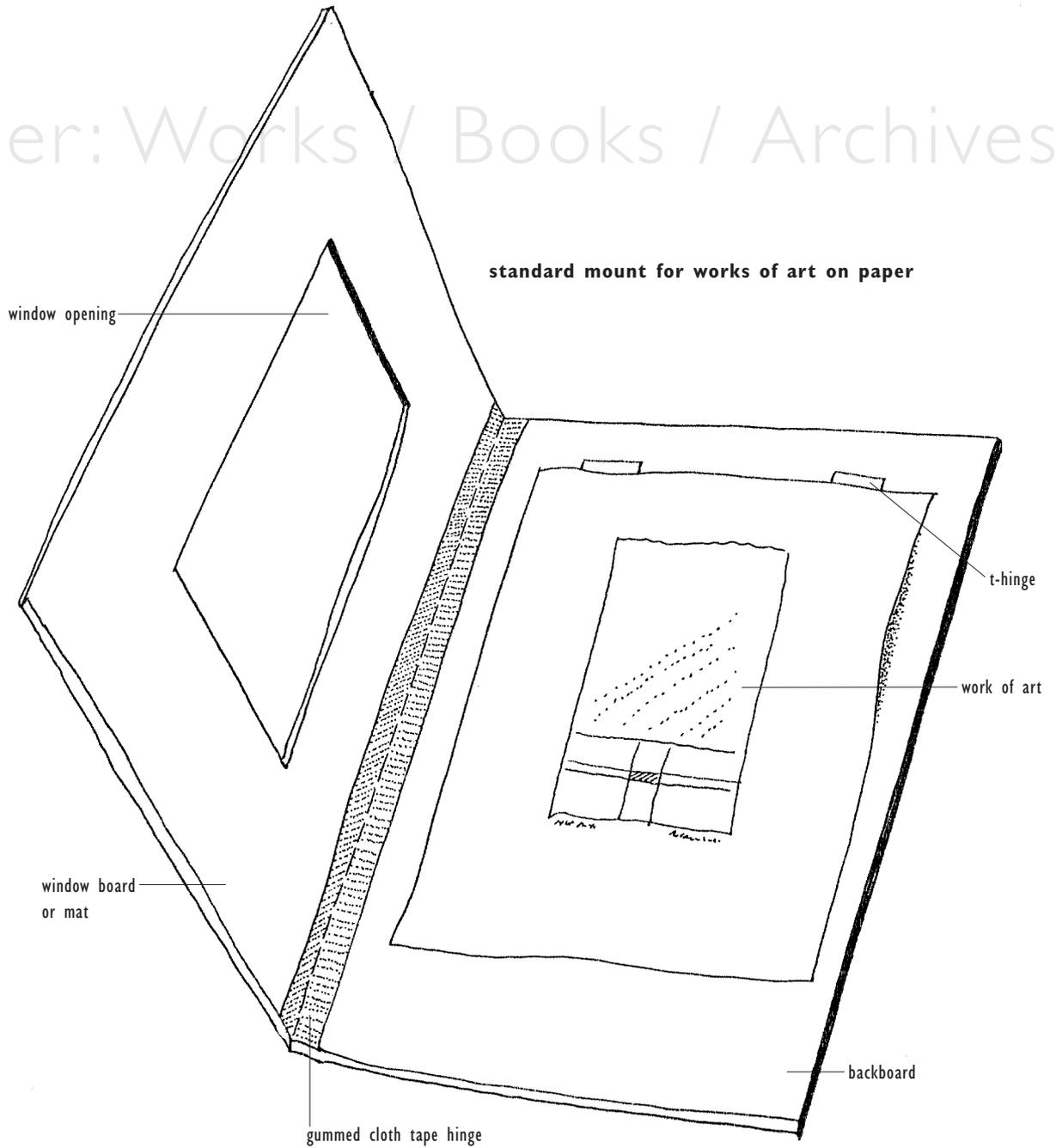
Squares of Vilene and blotter

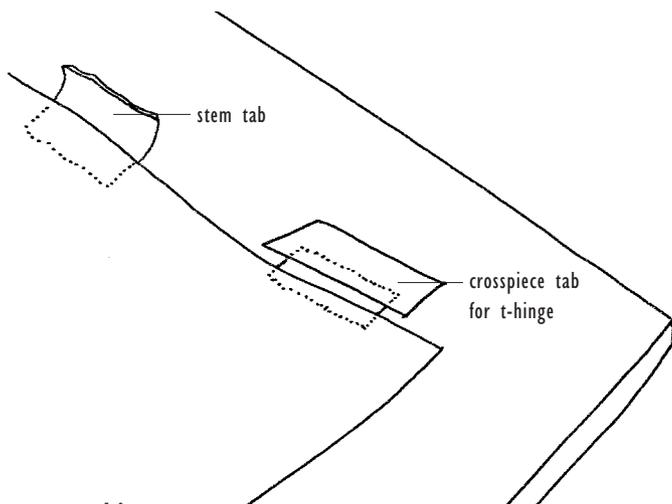
Methyl cellulose paste or wheat starch paste

Japanese tissue

■ *Cutting the Window*—most mount-cutting equipment cuts an angle of 45° to the window which reduces the possibility of shadows being cast onto the surface

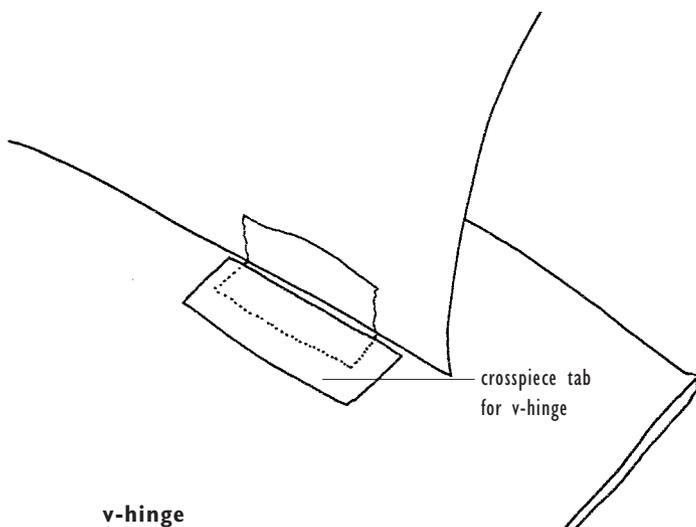
Paper: Works / Books / Archives





t-hinge

used when the window-mat margins overlap the margins of the work



v-hinge

used when the work is to 'float' in the window mat

of the image. To avoid scuffing the surface of the mount board, the window should be measured and cut from the reverse side. The edge of the window should be cut to overlap the edge of the work of art on paper by at least 2 mm. Lightly draw out the window onto the mount board using a graphite pencil. Cut the window out along these lines, and then erase any remaining pencil marks. The cut edge of the window may have a slight burr, and this can be reduced by burnishing with a bone folder.

The window board and backboard are usually joined along one of the longer edges using a strip of gummed linen tape. The linen tape is moistened using water, or can be pasted with dilute methyl cellulose paste for extra adhesion. Weight the two pieces of board to prevent movement and firmly press the linen tape over the centre of the join. Cover with Vilene and blotter and weight until dry.

■ *Hinges*—a work of art on paper should never completely adhere to a backboard. The most satisfactory way of attaching the work to the mount is with hinges. This method securely holds the work in place, but at the same time does not restrict the natural expansion and contraction of the paper support. Hinges are easily removed should remounting be required, and allow both the front and the back of the work to be viewed when the mount is open. A work of art on paper should never be fixed to a window board.

Japanese tissue, available from conservation suppliers in a range of weights, colours and textures, is the best material for hinging works of art on paper. Not all Japanese tissues are suitable, as some may contain woodpulp. Ensure that the supplier can guarantee the quality of the fibres used in the tissue. The tissue should be weaker than the paper support on which it is used. The size of hinge, method of application and number of hinges should be adapted to suit the work of art being mounted. Obviously a large or heavy work will require more hinges of a heavier weight tissue, than a small watercolour.

A feathered edge is made on the Japanese tissue when preparing hinges, to prevent ridges forming in the paper support when the hinges are applied. This is achieved by gently scoring a strip and then applying a line of moisture with a fine brush along the length of the tissue. The strip is gently pulled from the sheet, and appropriately sized hinges divided from the strip in the same manner.

■ *Paste*—two adhesives are recommended for hinging, methyl cellulose and wheat starch. Methyl cellulose adhesive is available from conservation suppliers (see also pages 63, 65) and should be made up to the manufacturer's specifications. It will keep for several months if carefully made up in a sterile container, but lacks the adhesive strength of wheat starch paste. Dry wheat starch should be of the purest quality and gluten-free, and is available from chemical or conservation suppliers.

Recipes vary, but are generally based on a ratio of 1:7 starch to water, weight to volume. The cooked paste will last for up to a week, stored in the refrigerator, under water. To use, a small amount of the

paste should be pushed through a fine sieve and then diluted with water to achieve the desired consistency.

■ *Applying the Hinges*—most works will require at least two hinges, applied to the top edge, but additional hinges may be necessary if, for example, the edges of the work are not covered by the window mount. In this case hinges should be applied both to the top and lower edges of the work of art. To apply the hinges, place the work of art face down on a sheet of Vilene or a clean surface, and weight to prevent movement. Apply a thin layer of

paste to the portion of the hinge to be joined to the back of the work of art. This area should be minimal, but large enough to support the work when it is adhered to the mount. Brush the pasted hinge gently into place on the top edge of the work and cover with Vilene and soft blotter, then weight until dry.

Position the work of art, face up, in the prepared mount and weight to prevent movement. Place a square of Mylar next to the hinge and fold the part of the hinge not adhered to the work of art over on to the Mylar. Apply a thin layer of paste and brush the hinge on to the backboard, cover with Vilene and blotter and weight until dry. For additional support, an extra T-hinge can be applied across the hinge as indicated in the diagram for the completed mount.

Paste recipe

50 g pure wheat starch
300 ml de-ionised or distilled water

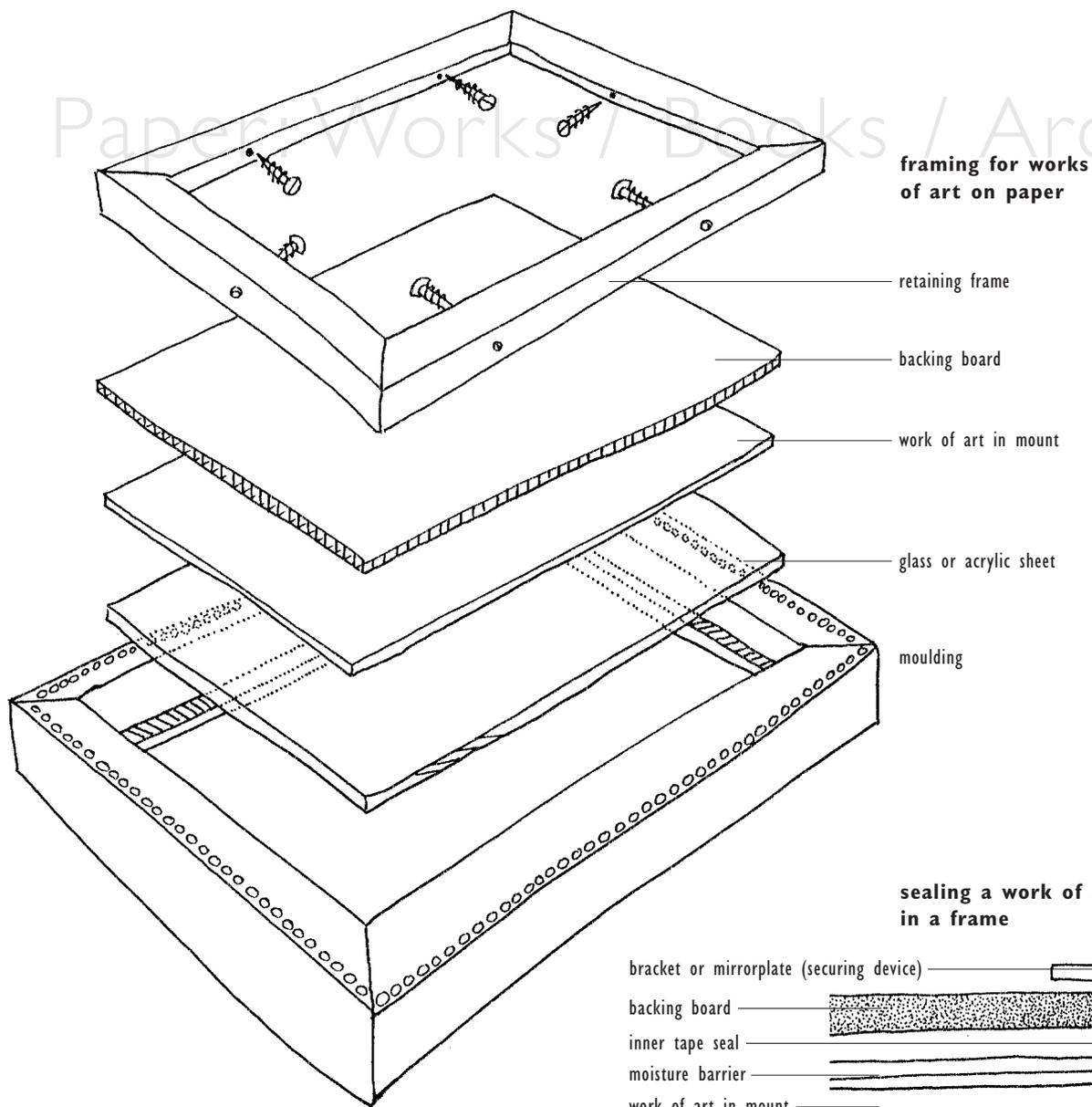
Use either a double boiler, or a Pyrex pan directly on a low heat. Stir the dry wheat starch into the water and bring to the boil, stirring vigorously all the time. The mixture will gradually thicken and become opalescent. Cooking should continue for at least 15–20 minutes after the mixture has thickened. Remove the pan from the heat and gently run cold de-ionised or distilled water onto the paste. Alternatively, microwave on high for 5–8 minutes, stirring every 30 seconds.

Conservation Framing

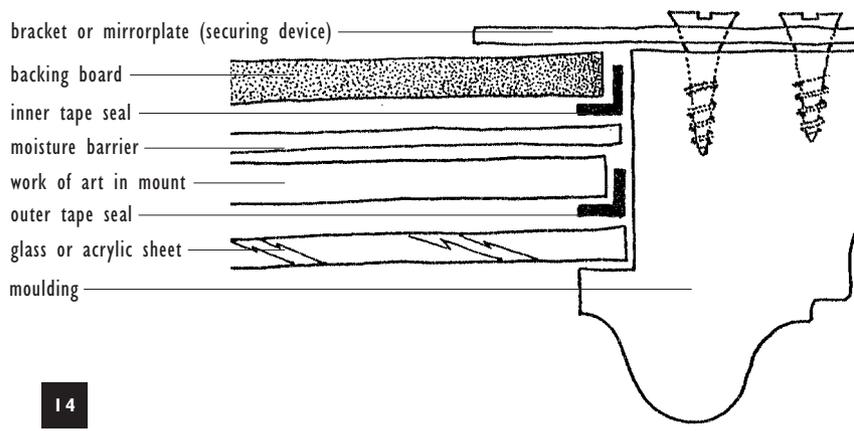
■ *Unframing*—damage can result from careless unframing of works of art on paper. Examine the work thoroughly before unframing for any potential fragility such as flaking paint and tears in the support. Check that no part of the work is adhered to the interior of the glazing.

To remove the work from the frame, invert the frame on to a padded table. Gently take out any securing devices and hanging fixtures. Whenever possible, securely hold the components in the frame together, the glazing, the work, the mount and the backing, and remove them from the moulding at the same time. Once the moulding is removed the elements in the frame can be carefully separated.

■ *Framing*—serves two functions; it protects and it enhances the work of art. Original frames should never



sealing a work of art on paper in a frame



be automatically discarded. An original frame may have been the choice of the artist or may be historically important. Original frames can often be adapted with minimal intervention to fulfil the required standards for conservation framing.

■ *The Moulding*—the frame moulding should be rigid and strong enough to carry all the components, the mounted work, the glazing and the backboard, without bowing or distorting. The frame rebate should be deep enough to seat all the components comfortably. Works on paper should always be mounted before framing to ensure that the image is separated from the interior of the glazing and that the work is fully supported. This may be overmounting, as previously described, or may involve the inclusion of a spacer of acid-free board in the frame.

■ *The Glazing*—all works of art on paper should be glazed to protect them against the damaging effects of the environment. Glass glazing is most commonly used. The disadvantages are that it will cause damage if broken, and large works can become excessively heavy when framed behind equally large sheets of glass. Acrylic sheet, such as Perspex and Plexiglass, is lighter and more flexible than glass, but will scratch and carry an electrostatic charge which will affect some media.

Ultraviolet filters are available for both glass and acrylic glazing, but have a limited lifespan, and should be regularly checked. Matt glass does not have any special light-filtering properties and it is not recommended, as to give a matt effect it has to be placed directly in contact with the surface of the image.

■ *Pastel, Charcoal and Other Friable Media*—friable media, such as pastel and charcoal, are easily damaged. The loosely bound nature of the particles means that these works must always be framed using glass. The electrostatic charge of acrylic glazing will disrupt and attract the media. Because of their delicate nature, unframed pastel and charcoal works should never be stacked, and may require individual boxes for storage.

■ *The Backing Board*—to give additional protection a backing board should be included in the frame. The backboard should be rigid and preferably acid-free. Materials recommended for use include Fome-Cor (a polystyrene core faced with acid-free paper) and corrugated acid-free cardboard.

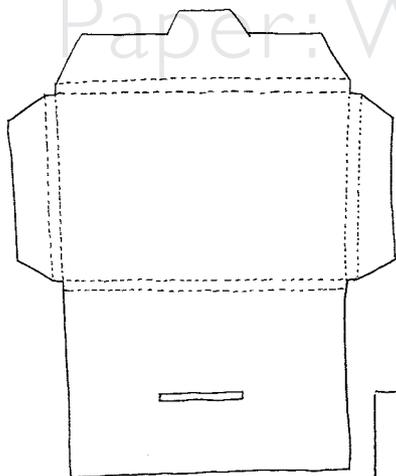
■ *Securing and Sealing the Backing*—the backing is secured using framer's nails, known as 'brads', or glazer's points. Care should be taken not to damage the moulding when using this method as the brads and points are propelled from the gun with considerable force. Brass nails have the advantage of not rusting. Another method which is particularly useful when the moulding is fragile is to secure the backboard using brass mirror plates screwed into the moulding. Standard gallery frames often make use of a retaining inner frame, which allows for easy rotation of mounted works.

To exclude dust and insects, brown gummed Kraft paper tape is used to seal the gap between the backing and the frame moulding. The tape can be coated with dilute methyl cellulose paste for extra adhesion.

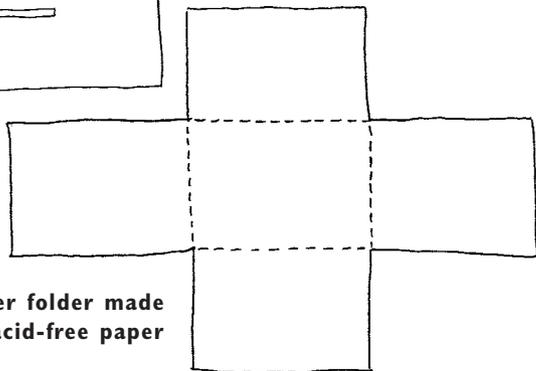
■ *Hanging Fixtures*—D-rings are adequate hanging fixtures for framed works on paper, although oversized works may need to be hung with more substantial fixtures such as marine cleats. The D-rings should be strung with strong nylon cord.

Storing Unframed Works of Art on Paper—whenever possible works of art on paper should be mounted prior to storage. Unframed works are usually stored horizontally. The mounts should be standard sizes to fit into standard-size storage boxes, files or drawers. Before storing on shelves or in cabinets, works must first be placed in acid-free boxes. If wooden shelving or cabinets are used they should be sealed and allowed to dry thoroughly, then lined with acid-free board or paper. Baked enamel shelving and cabinets can also be used for storage of works on paper in files and boxes.

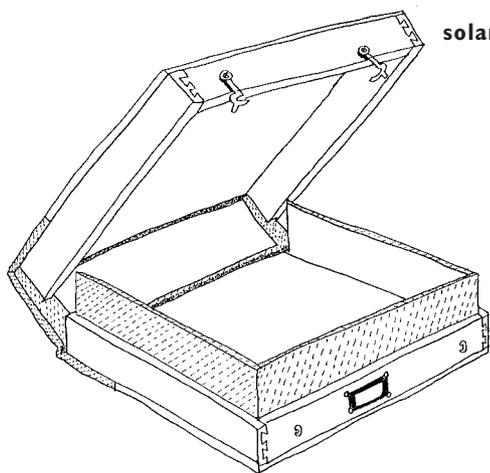
Shelves should not start at ground level, as they tend to become grubby and are likely to be damaged in



**outer folder made
of acid-free paper**



**inner folder made
of acid-free paper**



solander box

the event of flooding. It is sensible to put larger, heavier boxes on the lower shelves for ease of access.

■ *Storage Boxes*—commercially available storage boxes, known as solander boxes, are available in standard sizes, constructed from a variety of acid-free materials. Boxes should be strong and rigid, and made from the best quality materials. The lid of the box should fit well to keep out dust. Simpler storage boxes can be constructed from acid-free corrugated card. Storage boxes should never be overfilled as this will result in damage to the works of art.

■ *Folders*—are useful as extra protection when storing works in cabinets and drawers, and also for storage of large works of art on paper. Folders prevent movement and abrasion of works when drawers are opened and closed and works removed. Folders should be made from 2-ply acid-free board, although larger works may require a thicker board so that the folder is rigid enough to support the work. Folders with four flaps secure the work most effectively. The board should be lightly scored before folding in the flaps.

■ *Storing Large Works of Art on Paper*—flat storage is recommended for large works of art on paper, in folders or interleaved with acid-free tissue in shallow drawers or boxes.

Large works of art on paper should only be rolled as a last option. The work should be rolled with the image side out around a large-diameter tube made from acid-free board or covered with Mylar. Once rolled the work should be wrapped in acid-free tissue. This method is not suitable for fragile works such as those with cracked, flaking or friable media.

Storing Framed Works of Art on Paper—framed works of art on paper must be stored vertically, with the image the right way up. Exceptions to this are fragile works, such as pastels, which may require horizontal storage due to the loosely bound media. Framed works stored on shelves must be divided with sheets of board, and should not be tightly packed.

Books

Books are made up of many organic component parts, particularly paper, leather and cloth. They can be bound in a variety of styles. Often 19th and 20th century books are bound in full leather, which tends to be very friable. Many New Zealand bindings dating from the early 20th century are predominantly cloth case bindings. More recent books are often cheaply produced paperbacks and a lot of significant material is bound in plastic spiral format. Both the materials and the style of the binding contribute to deterioration. However careful handling and storage can significantly increase the longevity of books.

Handling

■ *Removal from Shelves*—a book should be removed from the shelf by reaching over the top of book to the fore-edge and then gently edging it out. When this is not possible, the books on either side of the book that is to be removed need to be gently pushed back and when the spine is sufficiently exposed, the book can be removed. This method ensures that head caps are protected from being pulled on, which can cause irreparable harm to a book.

When a book is removed it is necessary to adjust the other books on the shelf so they do not flop or lean over. An easy and safe method is to insert a book block which can be made from a block of wood covered in an acid-free board (lots of book blocks can be made to different sizes). Book ends often have extrusions that can harm books.

If a large, heavy book is being removed from a shelf, it is a good idea to have two people present, so that while one person is removing the book, the other can make sure that none of the adjacent books fall.

When books are being carried it is important never to carry more than your hands can actually encompass. If a number of books are being shifted a padded trolley should be used. Always make sure a space is ready to receive any book that is removed.

■ *Reading*—when reading a book it is important to support the cover so that it does not drop down, thus placing a strain on the hinges. If the book is of average size the reader can carefully support the cover by placing a hand underneath it. Larger, heavier books may require to be fully supported. For this purpose a soft, cushioned book cradle can be made from a linen material filled with small polystyrene bubbles.

When using such a cradle it is important to ensure that the cushion is properly indented where the spine is going to sit, or else the cradle can distort the book. If the binding material is easily marked, (especially if it is paper or cloth), gloves should be worn when both retrieving and reading the book. If the paper is fine and/or fragile, gloves may be too clumsy for turning the pages. In this case use clean hands and/or paper fingers (see also page 23).

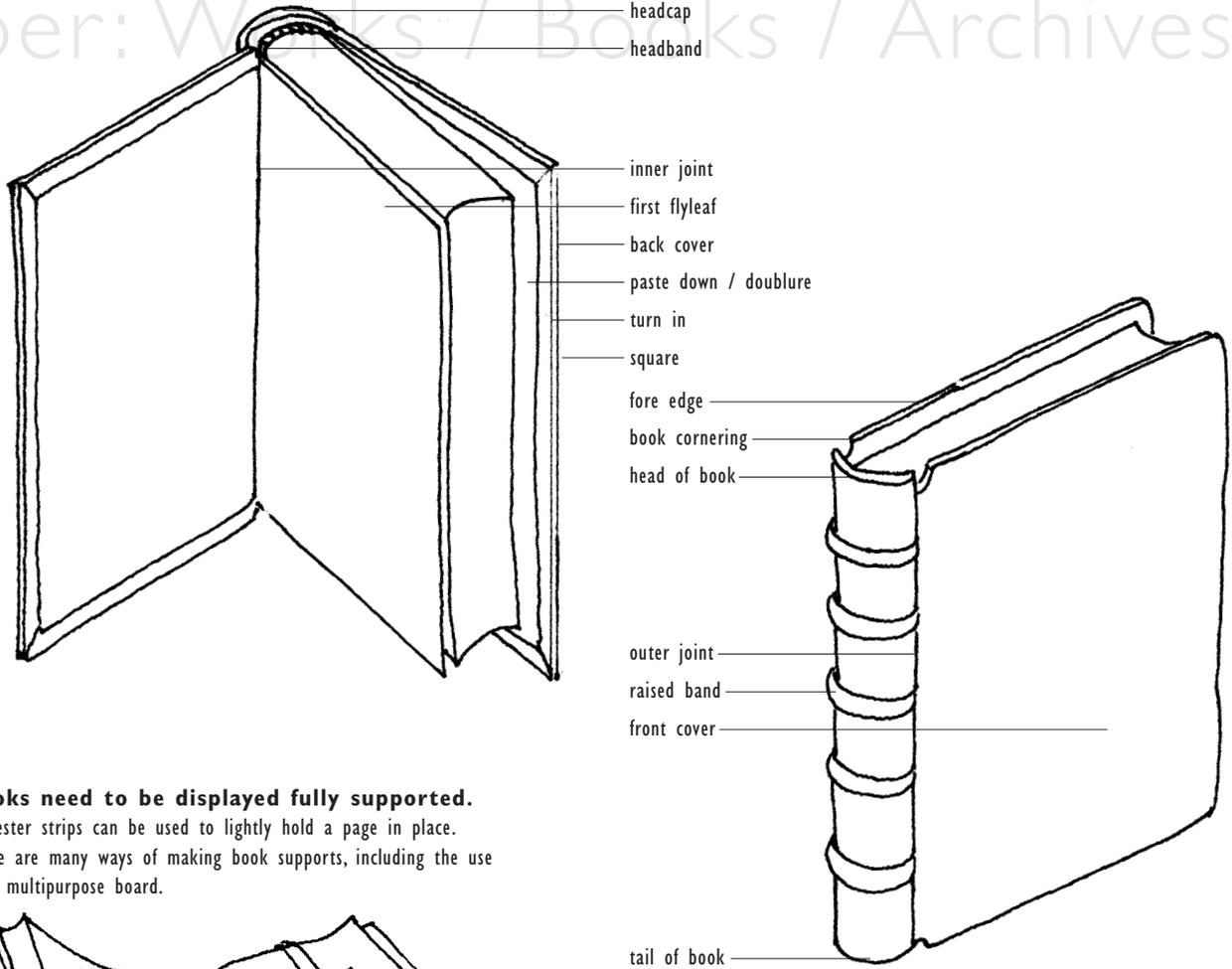
■ *Photocopying*—all books and documents are vulnerable to photocopying. Valuable hard-bound books should not be photocopied at all. The act of pushing a book down on a flat-platen photocopy machine is very damaging. If a book is to be photocopied, no pressure should be exerted on the spine; a slight blurring of inner margins has to be acceptable.

There are special photocopy machines, available in some of the larger institutions, that help reduce the damage done to bindings. The book can be photocopied in such machines without being fully opened.

■ *Opening Books*—new books, or tightly bound books, are prone to having their spines crack if they are forced to open flat. They must be opened very gently by holding the text block upright in one hand and with the other hand opening the front cover and easing it down by gently pressing along the hinge. This action should be repeated with each section of the book until the middle is reached. The same procedure can then be followed from the back cover. The whole exercise should be repeated several times.

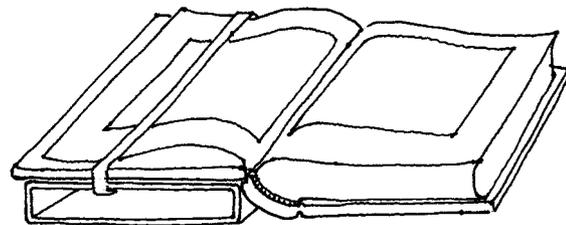
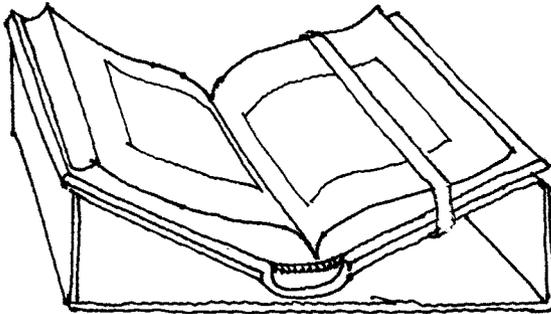
No form of accession number should be adhered to any books of value. Accession numbers can be written

Paper: Works / Books / Archives



Books need to be displayed fully supported.

Polyester strips can be used to lightly hold a page in place. There are many ways of making book supports, including the use of a multipurpose board.



on a heavy acid-free paper flag which can be placed inside the book. Such flags should be about 50 mm wide and protrude above the book by about 60 mm.

Cleaning—books and archive storage areas should be cleaned regularly as part of an overall preservation policy. Dust has an abrasive action as well as attracting insects and supporting the possibility that mould may flourish.

Dusting is especially important for collections that have a high incidence of red rot. This is common with leather books where the leather has degraded, becoming reddened and powdery. All floor surfaces, the top of any ducting, and the top of shelves should be vacuumed. (Special high-efficiency filters and nozzles can be attached to a Tellus-type vacuum cleaner.)

Books can be removed from one shelf at a time and placed on a table or trolley. Shelves should be wiped clean with a cloth lightly dampened with water and a mild detergent such as Lissapol. Water in any form of container should never be taken into a storage area because of the risk of spillage.

To dust a book, hold it firmly as if it were a block of wood, so as to avoid pushing dust down between the pages. Take a soft brush such as a shaving brush and lightly dust along the top edge of the book from spine to fore-edge. Sometimes dust will have collected inside the inner joints. This can be brushed away lightly using a soft sable brush.

If books are very fragile, it is better to leave them. When dusting books they should be moved to an area where there are no other books or collection items. If this is not feasible, set up the nozzle of a vacuum cleaner like a dust-buster (cover the opening with a piece of muslin), and ensure the dust is sucked up by the vacuum.

Leather dressings are potentially damaging to books and should not be considered even if the dressing carries a conservation-style label indicating that it can be so used.

Storage—books should not be stored directly against walls. (Outside walls should be avoided altogether.) They should be at least 100 mm from the wall surface, to ensure that they are well ventilated. Special care has to be given to ventilation in closed cabinets.

Shelving is best made of baked enamel steel. Wooden shelving can be partly protected by being lined with acid-free buffered board which is changed regularly.

Books in good condition and of average size should be stored upright. Books should be shelved so that they are not leaning over because this places strain on the binding. However they should not be packed so tightly that the bindings, especially cloth ones, become skewed. Moreover bindings can become abraded when they are removed from a tightly packed shelf.

Books should always be stored on shelves that are sufficiently large to fully support them. If they extend over the edges of shelves they can be easily bumped and damaged. Books are also damaged if they are stored on their fore-edges. This weakens the sewing structure and causes it to break down.

Wherever possible books of the same size should be stored together. Large, heavy books and books that are fragile should be given flat storage. No more than one or two books should be stacked on top of one another; if a book is very heavy it should be stored singly.

If a book has bosses, clasps, etc, it needs to be stored separately from other books and can lie flat on a piece of Plastazote to prevent any abrasions. Sometimes if there is a shortage of shelving space and/or the binding is required to be highly visible, storage of books (in good condition and not too big) can be provided by book shoes. These provide protection for the book and give support to the text block by the insertion of a piece of foam placed underneath it.

Leather bindings with red rot need to be isolated from cloth and paper bindings that can be very easily marked. If they are of average size they can be put into book wrappers made of a lightweight acid-free buffered card. They can be further protected by being wrapped

Paper: Works / Books / Archives

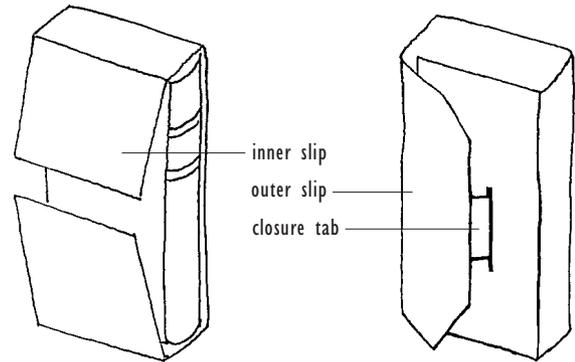
first in acid-free tissue. This will protect the wrapper from excessive marking and the tissue can be readily replaced.

Soft bindings, such as those bound with plastic spirals, can be stored upright in manuscript/pamphlet boxes made from multipurpose board or bought from a supplier.

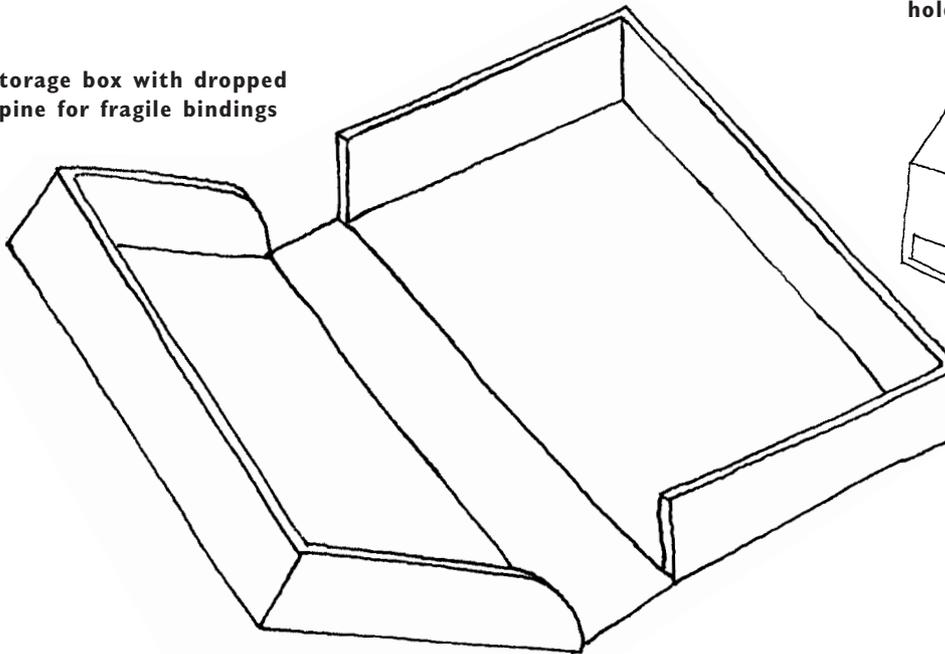
Fragile bindings need to be put into boxes and stored flat. This is the very best protection for them. Such boxes need to be individually constructed. The best style is the box that has a drop-spine. These can be made from multipurpose board without the need for specialised equipment.

Books should not be stored in slip-cases as these readily abrade their covers. All enclosures for books need to be made precisely.

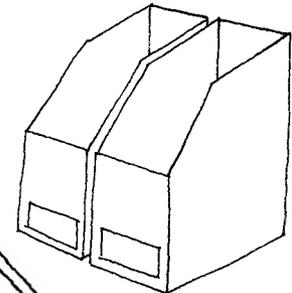
custom-made book wrapper



storage box with dropped spine for fragile bindings



manuscript boxes can hold soft bindings



Archival collections

Archival collections can be made up of documents, letters, diaries, ledgers, journals, scrapbooks, newspapers, maps, plans and ephemera such as postcard collections.

Handling—storing papers in the manner described below will help minimise direct contact with a document. Documents should be lifted on supporting interleaving paper. To see the back of the document another interleaving sheet can be placed on top and the document turned over. If the document is in a paper folder this can be used to handle it. When a large number of papers are being looked at it may be impossible to avoid directly handling the items. In this case gloves can be worn or paper fingers used. Paper fingers (see also page 23) are made from a small square of acid-free paper folded on the diagonal so a triangle is formed. The open-ended apex of the triangle is slipped around the document to be moved, one ‘finger’ at the top of the document and one at the bottom.

Care should be taken to lift paper rather than drag it across other documents below. Such an action will scratch and abrade any print or image on the paper. Encapsulation also provides a safe way of looking at items.

Where documents are being repeatedly looked at and are fragile, they can be photocopied on to acid-free buffered paper. A second master copy should also be made at the same time, so that the document does not ever need to be re-photocopied.

Storage—archival collections are often difficult to store because of their wide range of formats, from a single leaf of paper to a group of papers in book format. Papers should not be folded. If the paper is very brittle or does not willingly unfold get advice from a conservator.

Metal paperclips, staples and rubber bands should generally be removed, but care must be taken to keep the original sequence of papers intact; in cases of valuable historical material such fasteners should not be

automatically removed. Where fasteners are removed they can be replaced with plastic-coated clips placed over a small fold of acid-free paper. Fasteners can sometimes be avoided altogether by putting groups of papers in separate folders of acid-free buffered paper.

Documents etc are best stored flat within folders and housed in document storage boxes. Folders can be purchased or made from an acid-free buffered board such as archival manila or 10-point Library board. Within each box the folders should be the same size.

Folders and boxes must not be overfilled. Folders need to be bigger all around than the papers they are housing; in turn the papers can be interleaved with single leaves of acid-free buffered paper uniformly cut to the same size as the folder.

Books such as diaries and notebooks should not be stored with paper because of the uneven pressure they can exert. They need to be boxed separately. Several can be put in the same box by making partitions. Such boxes should always be stored flat.

Where space is at a premium, it is not always practical to keep all papers in flat storage, which should be reserved for fragile items. If upright storage is used, folders within boxes need to be carefully filled so that when they are upright the material does not fall and slump. A box can be made to exact size or if a standard size is used, a spacer that is the height of the folder can be made from multipurpose board folded to form an open-ended rectangle.

■ **Newspaper Clippings**—newspaper clippings and anything printed on newsprint have a high acidic content. They need to be isolated from other material by being placed in a paper fold. Clippings can also be photocopied onto a buffered acid-free paper and stored separately.

■ **Scrapbooks**—these are often made of poor-quality materials and they commonly have a variety of material pasted into them. However no attempt should be made to dismantle scrapbooks. Sometimes it may be possible to photocopy them.

If they are very important, photographs and/or a microfilm could be taken. They can be partly protected by being interleaved with a buffered acid-free paper uniformly cut to the size of the page. If concerned, seek the advice of a conservator.

■ *Damaged Material*—often documents have sustained tears and abrasions. No attempt should be taken to repair these. Pressure-sensitive tapes, even those that are called archival reversible tapes, should not be used. Over time they can cause mechanical damage to paper.

■ *Encapsulation*—some support can be provided to a torn or fragile item by encapsulating it in a polyester film such as Mylar or Melinex (see also page 62). This is done by carefully sandwiching the single sheet of paper between two pieces of Mylar cut about 50 mm larger all around than the document. The Mylar should be sealed on two sides only—one vertical and one horizontal. This means that the document can be readily removed and it allows a greater exchange of air which is important for acidic items.

Sealing is accomplished by using a 3M acid-free tape. The document should be positioned so that it is well clear of the tape. There are also welding machines that can seal Mylar.

Items should not be indiscriminately encapsulated. Any paper that is highly acidic and/or brittle should not be encapsulated. Mylar has slightly electrostatic properties that can lift pieces of brittle paper.

Note that the PVC plastic enclosures available commercially are made from products that are very harmful to paper-based items. You cannot distinguish between archival and non-archival plastics by looking at them. Archival plastics are made from polyester, polypropylene and polyethylene.

■ *Maps and Plans*—these are best stored flat. Outsize plan chests are available for this purpose. If they are being specially made, request that the hinged flaps are removed.

Maps need to be put into folders all uniformly cut to

fit comfortably within the plan drawers. No more than ten maps should be put within a folder and these should be interleaved with an acid-free buffered paper uniformly cut to fit the size of the folder. The folders can be made from large sheets of acid-free buffered board. If a single sheet is not large enough two or more can be joined together with a PVA glue and a fold made about 50 mm deep at the top. All should be single folders without flaps; the fold is positioned at the opening edge of the plan drawer. A pencilled accession number should be put on the fold edge for easy identification.

Blueprints should not be stored in folders with an alkaline buffer because they do not react well to alkaline media. Folders that are neutral and lignin-free are suitable for blueprints.

Often maps are oversized and cannot fit into a plan drawer; such maps require rolled storage. However if they are brittle and/or fragile advice should first be sought from a conservator. A textile tube, with as wide a diameter as possible, is cut 300 mm longer than the width of the map. Each tube needs to be covered in Mylar as a protection against acidity. Maps can be rolled in groups of four to six but some will need to be rolled individually. Tyvek can be used as an interleaving material by being rolled around the tube, fixed in place with an acid-free double-sided tape and then cut a little longer than the map(s). The map(s) are then placed on the Tyvek and rolled so that the image side is to the outside of the tube. The roll is tied at both ends with cotton tape.

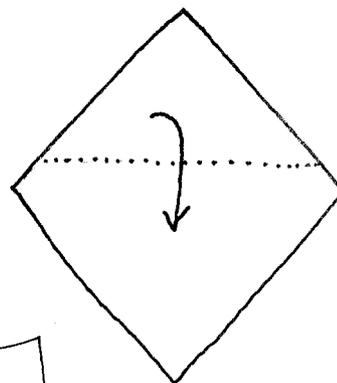
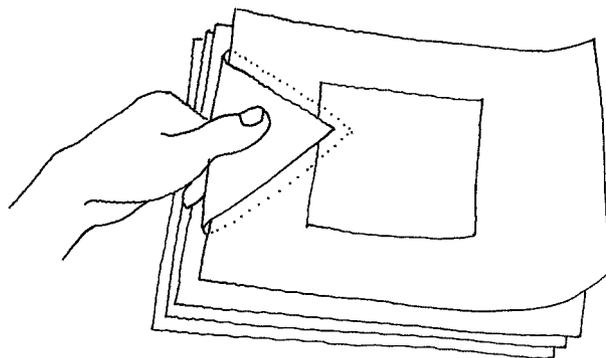
Display of Books and Documents—(see environmental requirements for works of art on paper, page 9.) Printed books can tolerate a higher lux level than manuscript material, but as they are often exhibited together 50 lux is recommended. In order to avoid light damage and any distortion of material, three months is the maximum exhibition time. For light-fugitive documents the time needs to be shorter or a good quality photocopy could be substituted.

Paper: Works / Books / Archives

Books need to be displayed fully supported. Polyester strips can be used to lightly hold a page in place. There are many ways of making book supports, including the use of a multipurpose board.

For further information and advice regarding the preservation of documents and making of enclosures, contact the National Preservation Office Te Tari Tohu Taonga (an initiative of the National Library and National Archives), located at the National Library, Wellington.

lift documents with a supporting piece of paper (paper fingers)



the paper is folded as shown to allow a larger, lower flap to slip easily under the print / document

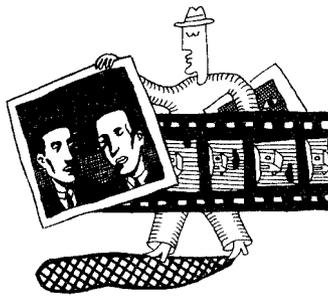
Photographs

Photographs are most commonly found in the form of negatives, slides or prints. While these are among the more complex and fragile objects in galleries, museums or libraries, they can have a long life. The life-expectancy of photographs depends firstly on the type of photographic process (black and white, colour, etc); secondly on how well the photographs were processed; and thirdly on the way in which the photographs are handled and stored.

Photographs are multi-layer structures composed of a variety of materials. These typically include:

- a base layer such as film, glass, metal, paper or a plastic resin-coated paper
- a binder coating on top of the base made from gelatin (a highly purified form of gelatine), albumen (from egg white) or collodion (an early plastic) which holds the image material in place
- the image material, which may be fine grains of silver, for black and white images, or organic dyes for colour negatives, transparencies or prints.

Each of these components or layers has specific properties and sensitivities to the environment. In caring for photographs, all the layers need to be taken into account. Most colour photographs have a shorter life-expectancy than images in black and white.



Causes of Deterioration

The environment includes several factors which can cause the most damage to photographs.

■ *Temperature and Humidity*—this includes both the temperature and the relative humidity of the air (see also page 1). Chemical activity and therefore deterioration occurs more rapidly at higher temperatures. In very moist conditions, gelatin swells and becomes tacky enough to adhere to nearby surfaces. With high

relative humidities, mould grows on the gelatin or paper. Moisture also enables insects to breed and thrive. In very dry situations, gelatin becomes brittle.

■ *Chemical Contamination*—photographic images are extremely sensitive to chemical contamination. This can come from internal or external sources. Internal contamination is principally the result of poor processing where the photograph was either inadequately fixed or washed. Poor fixing causes image staining (darkening or discoloration) and poor washing leaves residual fixer in the photograph which can cause fading (lightening) of the image. Another source of chemical instability occurs in film, where the cellulosic plastic film base breaks down, creating acids which in turn affect the image material or speed up the degradation of the base. Film base deterioration is dealt with in more detail elsewhere.

Photographs

External causes of contamination are much more numerous. The air around us at home or work can carry several gases which will cause rapid and irreversible damage to images; these include sulphur dioxide, hydrogen sulphide and acids formed by sulphur dioxide, nitrogen dioxide, carbon monoxide and ozone. These and other gases come from a range of sources as common as engine exhausts, factory emissions, house paints, contact adhesives, cleaning products, geothermal activity and office equipment. Minute quantities of these gases can cause staining or fading in the presence of moisture.

Physical contact with other common chemically active materials including wood products, plywood or chipboard, acidic paper envelopes, adhesive labels and pressure-sensitive tape, cleaning materials, insecticides and fungicides, certain plastics and adhesives, rubber products, uncoated steel and inks will also cause damage to images.

■ *Light*—photographs are susceptible to damage by light (see also page 3). Colour dye images are more fugitive (prone to fading) than are black and white. Ultraviolet wavelengths, found in abundance in sunlight and fluorescent tubes, are particularly damaging.

■ *Physical Damage*—abrasion, creases, bends and tears are common symptoms of inadequate physical protection or support.

■ *Biological Attack*—photographs provide a rich source of food for insects and mould. Insects such as silverfish readily eat paper in photographic prints. Mould can also make gelatin water-soluble. Human fingerprints will, over time, cause permanent damage to photographs.

Handling

Avoid touching the surface of a photographic print or a negative with your fingers. Permanent damage will eventually result from skin oils and salts. Wash your hands and handle photographs by the edges only. Wearing clean cotton gloves is a good practice.

Always treat your negatives with care. If a print is lost or damaged, the negative will enable another copy

to be made. Keep them cool, dry and dust-free. It is also important to label the sleeves or envelopes for your negatives. Basic information such as the date, photographer, subject and location, written on the sleeve will prevent unnecessary damage through handling and save time when you are searching for a particular image. For large collections particularly, a numbering sequence and catalogue is important.

Do not write on the back of prints with ink. Avoid using pressure-sensitive labels or tape. If it is necessary to write on the back of a print, use a soft pencil (2B) in the border area.

Storage

The ideal environment to achieve the longest possible life-expectancy for photographs is a fairly unattractive place for domestic habitation, being dark, dry and cold. Some museums, galleries and libraries maintain special rooms with constant climate control and air purification equipment for storing their collections. Individuals can enhance the stability or prevent deterioration of their own collections by choosing suitable enclosure materials and keeping them in a clean, climatically stable environment.

Tragically, many products commonly used for photographic storage are unsuitable for long-term preservation. These products include PVC (polyvinyl chloride) plastic storage pages, ordinary paper envelopes, ordinary cardboard, rubber bands, rubber cement adhesives, spray adhesives, glassine negative sleeves and albums with chemically unstable pages (see also page 26). Such materials should be avoided and, if in use, systematically replaced with chemically stable papers, card and plastics.

All negatives and colour transparencies should be stored upright and supported to avoid bending or damage to the emulsion caused by weight pressure. Prints should be kept flat to enable even physical support unless they are mounted and framed. If enclosures have seams, these should face the reverse of the image. Metal

Photographs

fasteners (staples, paperclips, and pins) should be removed as they may cause image staining or corrosion.

■ *Enclosures*

□ Negatives and transparencies—should be individually enclosed. Choose envelopes, sleeves or folders made from acid-free, alkaline-buffered paper or one of three chemically stable plastics. These are polyester (including Mylar and Melinex), polyethylene (Tyvek), or polypropylene. Colour images are affected by moderate alkalinity and where paper enclosures are in direct contact, these should be pH neutral, made from 100% rag pulp.

□ Prints—should be individually enclosed or interleaved. Choose envelopes, sleeves, folders (see also page 63), interleaves or mat and mounting boards (see also page 62) made from 100% cotton rag or highly refined wood pulp, buffered against changes in pH. Inert plastics (as above) can also be used. Colour prints and cyanotypes are affected by moderate alkalinity and where paper enclosures are in direct contact, these should be pH neutral, made from 100% rag pulp.

□ Albums—there are two types of album to avoid as materials in each will destroy prints in time: ‘magnetic’ albums and albums with PVC pages. Magnetic albums have clear plastic overlay sheets which hold the photographs in place against a stiff card backing with fine stripes of latex adhesive. After a few months, the adhesive can become rigid so prints cannot be removed and after a few years it causes discoloration and image loss. PVC is a plastic which slowly releases chemicals that cause irreversible damage to all photographs. PVC is often easy to identify by its smell—similar to that of new shower curtains or inflatable beach balls and paddling pools. Replacing such albums should be a priority for improving the storage of prints. It is a good idea to purchase a new album first.

Older albums should be kept intact and protected with an acid-free cardboard box (see also page 63). If old albums are so deteriorated that they no longer protect the prints inside, place the prints in a new, archival album.

Album pages should be made from good quality paper (100% cotton rag or highly refined wood pulp, buffered against changes in pH) and prints should be attached to the pages using photo corners. Never glue or tape a photograph into place. If photographs are on facing pages, it is a good idea to interleave the pages with acid-free tissue or paper.

If plastic covers or sleeves are used, be sure they are of suitable quality. Where a photographic storage enclosure is not identified as being safe for long-term photographic storage, it most likely is not.

□ Protective Boxes—photographs stored in boxes should be kept in individual enclosures. Ordinary cardboard should not be used and boxes should not contain adhesives and staples which may be harmful to photographs. Boxes made of acid-free corrugated board are suitable and these are available from conservation materials suppliers (see also page 63). Some recently developed card is designed to protect the box contents by absorbing gaseous contaminants from the atmosphere. Microchamber board is one such material. This is particularly useful where small collections are to be protected in areas with known air pollution.

Wood, hardboard and chipboard all emit chemicals which cause photographs to deteriorate. Solander boxes (see also pages 16, 65), if used, must be sealed with polyurethane, epoxy or polyester varnish and allowed to cure for 3 months prior to use. Boxes can be stored on shelving made of steel with baked-on enamel.

■ *Cabinets, Cupboards and Shelving*—steel filing cabinets are recommended for the storage of photographs. These are non-combustible and can be easily coated with inert coatings such as baked-on enamel or anodised aluminium. If wooden shelving is used, all surfaces must also be properly sealed. The use of wooden storage furniture is not endorsed by all conservators.

Storage cupboards, cabinets and shelves should allow air circulation but also provide protection against fire and water.

■ *Environment*—avoid placing photographs in attics,

Photographs

sheds, garages, cellars, near heaters or in the kitchen or laundry. These places have fluctuating climates. A stable climate is important and 20°C with a relative humidity of 50% is recommended. A lower temperature is preferable if relative humidity can be effectively controlled. Ideally colour film and prints need to be kept at 2°C.

Air conditioning which runs constantly can maintain the desired climate although this is not feasible for most domestic environments. A practical alternative is to locate the photographs in a cool, dry part of the building. Air circulation is also important. The air should be free of gaseous contaminants and dust. Air-conditioning systems can be designed to eliminate these in areas where they are a significant concern.

Avoid storing negatives in contact with prints. It is safest to keep them in a separate place to guard against loss. Be sure to keep collections off the floor.

Old cellulose nitrate film, because of its flammability and harmful decomposition products, should be stored in a separate place. It may be advisable to duplicate this film and consider disposal if the film deterioration is advancing. The New Zealand Film Archive has facilities for the storage and duplication of nitrate motion-picture film.

For colour materials, a cheap and effective method of storage for long-term preservation is low-temperature storage in moisture-proof packages. The film is conditioned in a dry atmosphere and sealed in moisture-proof bags which are then refrigerated or frozen.

Display

The guidelines for the display of photographs are similar to those for artworks on paper (see also page 9).

Photographs of high value should be displayed for short periods only. Older photographs in pristine condition will show the most image loss with extended exhibition. Original transparencies should not be projected and duplicates should be used for this purpose.

Valuable prints should be mounted and framed for display (see also page 14). The mount board should be acid-free and should contain a buffer which will main-

tain an alkaline pH except in the case of cyanotype prints and colour prints. Mount board in contact with these should be acid-free but should not contain any alkaline buffering.

Some modern black and white, resin-coated printing papers are less durable for display purposes than fibre-based prints. When illuminated, the paper's titanium dioxide whitener can produce corrosive compounds. If these are contained within a frame, they can cause minute red spots on the image surface. For long-term display, fibre-based prints are the best choice.

The application of any adhesive to the print paper should be avoided if possible although reversible hinges of Japanese tissue are acceptable. Prints may be attached to their backboards with corner pockets made of a suitable plastic film or acid-free paper. The corners can be attached to the backboard with an acid-free linen or paper tape.

Photographs on long-term display should be lit by no more than 50 lux. If it is not possible to illuminate them at this level, display time should be reduced. Colour photographs are particularly susceptible to fading and should be protected from excessive lighting. Always avoid display near windows or direct sunlight.

Framing provides protection from dust, dirt and gases which can damage the image (see also page 13). Framing also provides some protection against climate fluctuations. Frames for photographs should be made of aluminium in preference to wood. Frame backings should not be made of wood, hardboard or acidic cardboard. Acid-free corrugated cardboard and fluted plastic sheeting are preferable materials.

Processing New Prints

New photographs intended for a long life-expectancy should be processed with care. Photographs must be processed in fresh chemicals and given adequate washing. Additional treatments with sulphide, selenium or gold toners assist in protecting the images against chemical contamination.

Sound / Video Recordings

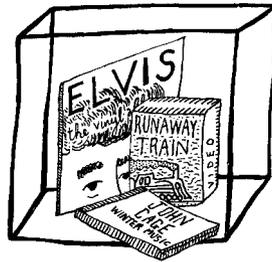
Most sound- and video-carrying materials gradually disintegrate over time. Sound and video recordings are subject to both chemical and mechanical damage. Lacquer discs are unstable and have a relatively short life, while wax cylinders and many shellac discs deteriorate more slowly. The rate of deterioration is influenced by the way recordings are handled and the conditions in which they are stored. The following information will help prolong the life of valuable recordings.

Discs

These include lacquer discs, 78 rpm shellac discs, vinyl discs and compact discs.

■ *Acetate (Lacquer) Discs*—were the medium used for instantaneous recording before magnetic tape took over. They consist of a base made of metal (usually aluminium), glass or fibre and a lacquer coating of acetate or cellulose nitrate plasticised with castor oil.

■ *Shellac (78 rpm) Discs*—‘Shellac’ has become a term that is often used to describe 78s (the discs that are quite heavy and play at an approximate speed of 78 rpm). Shellac itself was originally the resin secreted on the twigs of trees in Asia by a coccid insect (the lac) as part of its digestive process. In the mid 1940s commercial resins were used instead of shellac as the main ingredient in the production of these discs. Various



fillers were also used, which makes it difficult to determine how exactly ‘shellac’ discs deteriorate.

■ *Vinyl Discs*—have been a relatively stable medium for sound recordings and are made of polyvinyl chloride (PVC) and fillers.

■ *Compact Discs*—are a digital sound carrier. CD-ROM (read only) discs consist of a polycarbonate base with pits (impressions) and lands (smooth areas), a metal reflective layer (aluminium, chrome-aluminium alloy, gold) and a protective layer (acrylic).

CD-R (recordable) discs consist of a polycarbonate disc with grooves, a light-sensitive organic dye layer (cyanine, phthalocyanine, azo), a metal reflective layer (gold, platinum, silver alloy) and a protective layer.

Causes of Deterioration

■ *Water and Heat*—moisture and heat speed up the chemical reaction rate that leads to deterioration in discs. Rapid changes in temperature and humidity (cycling) can also cause warping or delamination of discs. In laminated discs the base and the coating have differing chemical and physical reactions and this can cause damage if the base and the coating expand and contract at different rates.

In lacquer discs the loss of the plasticiser causes the discs to become brittle, which leads to cracking and

Sound / Video Recordings

delamination (peeling) of the lacquer coating.

Additionally, the constituents of cellulose nitrate in the lacquer coating can react with water and oxygen over time to produce acids that become catalysts for other chemical reactions such as the formation of palmitic acid deposits (a white greasy substance) on the disc surface.

While shellac discs are relatively stable, condensation is the main cause of damage. Organic shellac is, additionally, soluble in alcohol.

Vinyl discs are thermoplastic (soften and flow when heated) and can warp.

In early CD-ROM manufacture, oxidation of the metal layer (aluminium) caused the layer to lose the ability to reflect the laser beam, making the data unreadable.

□ *Light*—CD-Rs have a dye layer that can fade when exposed to ultraviolet radiation for extended periods. PVC (vinyl) degrades chemically when exposed to ultraviolet radiation or heat fluctuations.

□ *Dust*—causes abrasions/scratches on the surface of the discs and can become embedded in the grooves, damaging the audio quality of the disc when played. Dust can also be produced from the materials in shellac discs as they dry out; it is then shed as a fine powder after each playback.

In compact discs, dust can cause scratching of the protective acrylic layer which will obstruct the reading of the data by the laser.

□ *Mould*—cellulose acetate in lacquer discs is fungal-resistant but fingerprints can encourage the growth of moulds. Shellac itself is also resistant to mould but the organic materials used as fillers in 78s may encourage mould growth.

Care and Handling—remove any manufacturer's sealed cellophane wrapping from discs as the tension of the wrapping may warp them. Avoid touching the grooves with your fingers. Handle discs by label and outer edges only. Ideally, clean cotton gloves should be worn.

Replace damaged or mouldy record jackets and inner sleeves. Keep discs in their jackets or enclosures when not in use.

Do not expose discs to physical hazards. These include sources of heat, direct sunlight, uneven surfaces or the floor.

Clean dirty items before putting them into storage. Discs should be cleaned with a soft, clean cloth working in a circular motion in the direction of the grooves. CDs should also be cleaned with a soft clean cloth but from the centre of the disc to the outer edge.

Storage—store discs in archival (acid-free) sleeves and jackets. The inner sleeve opening should be at the top. Discs are susceptible to physical damage if stored incorrectly. Store discs vertically on shelves with rigid dividers between them at 70 to 100 mm intervals to support the discs and prevent slipping and slanting. Keep the storage environment free of contaminants such as food, drink, smoke and dust.

Ideally the climate should be stable at about 20°C and 50% relative humidity.

Magnetic Tapes

Museum and library sound collections hold various 'containers' of magnetic tape (open reel, cassette and micro-cassette audio, and open reel, Beta, VHS and U-matic video, as well as floppy discs).

Magnetic tape consists of a base made of cellulose acetate, paper, polyvinyl chloride (PVC), polyethylene-terephthalate (PET, polyester) or metal; an adhesive binder such as polyester urethane (PE-U) or PVC; and metal oxide particles such as ferric oxide or chromium dioxide. Modern tapes also include a back coating (carbon black particles).

Causes of Deterioration

■ *Water*—hydrolysis is a chemical reaction which takes place when an ester such as the binder absorbs water to produce an acid and an alcohol. This results in

Sound / Video Recordings

the binder shedding a soft and gummy material which is left on the tape heads and can make the tape unplayable. Hydrolysis also weakens the bond between the binder and the base, leading to shedding or detachment.

Cellulose acetate tapes contain plasticisers and are prone to physical damage as a result of humidity/temperature fluctuations. Cellulose acetate tapes also tend to break rather than stretch, due to plasticiser migration.

The 'Vinegar Syndrome' is a chemical reaction where acetic acid is released as a by-product of the breakdown of the acetate tape. It can be detected as an acetic acid (vinegar) odour. This is an autocatalytic reaction which will 'infect' healthy tapes.

It is important to note that these chemical reactions happen over time and that in an emergency, most tapes can sit in water for an extended period without falling apart; they are hydrophobic (water-repellent) and the hydrolysis reaction is reversible. The exception is Soundmirror tapes, which are paper-based and should be treated as paper materials.

- **Heat**—magnetic tape is thermoplastic and inflammable. High temperatures can distort and disfigure the tape and the tape containers.
- **Dust**—attracts moisture which can lead to the chemical reactions described under Water and Heat. It can also cause permanent scratches/abrasions to the oxide layer of the tape when played.
- **Mould**—tape binder on older tapes is susceptible to fungal growth. Fungicide is added to modern binder formulations and prevents this.
- **Shock and Magnetism**—magnetic tape is also sensitive to shocks/vibrations where the tape pack is loosened, exposing the edges to damage.

Tapes should be kept away from strong magnetic fields as these can partially or completely erase the content.

Care and Handling—all tapes should be handled with care as they are easily damaged by physical and magnetic forces. Avoid exposing tapes to direct sunlight and keep them away from heat sources.

Keep tapes away from magnetic field sources such as speakers, televisions and magnets. Avoid violent vibrations or shock. Avoid stacking tapes. Avoid touching tape with your fingers.

Do not leave tapes out of their containers when not in use. This includes leaving tapes in or on the tape recorder.

Storage—store cassettes and videotapes in rewind condition. Store reel tapes 'tails out' (with the end of the tape at the beginning of the reel; that is, in the 'played' state), at an even tension such as the 'play' tension on a tape recorder.

Shelve tapes upright in individual boxes. Replace damaged boxes and spools. Keep the storage environment free of contaminants such as food, drink, smoke and dust.

Magnetic tape is sensitive to rapidly changing climatic conditions. The climate must be stable and ideally kept at about 18 to 20°C and 40% relative humidity.

Wax Cylinders

Wax cylinders are very fragile and handling should be kept to a minimum. They are susceptible to mould growth and should be kept in constant cool and dry conditions.

Paintings

Paintings can be made of many different materials but are composed primarily of a paint and a support layer. ‘Support’ is a term used to describe the physical structure which holds or carries the ground or paint film of a painting. Wooden panels, cardboards, canvases, metals and any of the flat expanses on which paintings can be made, fall into this category. Canvas usually requires an auxiliary support such as a stretcher to hold it flat.

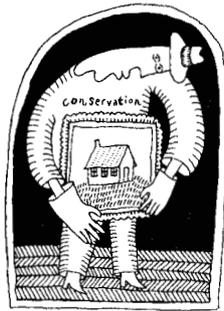
A preparatory layer between the support and paint is called the ‘ground’. Its purpose is to provide a texture and colour to work from, to seal the support to prevent soaking in and to protect the support from the acidic action of some paint.

The paint layers create the image and can be made up from a variety of media such as oils, acrylics and egg tempera, with pigments added. In addition, glazes or varnishes using different media may be applied and collage elements adhered.

Paintings are considered separately from watercolours, which are covered in Works of Art on Paper. The types of materials that make up a painting and their interaction determines the kinds of damage to which they will be most susceptible.

Causes of Deterioration

■ *Inherent Instability*—the environment will have a significant effect on the aging characteristics of a paint-



ing but the materials and techniques chosen by the artist are also a major contributing factor. The materials used to make up paintings will deteriorate as they age. For example, oil paint dries very slowly, becoming increasingly hard and inflexible, making it prone to cracking. Canvas, cardboard and particle board supports will discolour and

become increasingly brittle. Natural resin varnishes will deteriorate making them increasingly insoluble and discoloured.

Inherent instability can result from the use of incompatible materials, such as occurs when mixing oil and acrylic paint, which will prevent proper drying. The resultant surface will remain tacky and vulnerable to damage. A disfiguring ‘alligator pattern’ or ‘traction’ cracking can develop when a lean, quick-drying oil layer is applied over a slow-drying, oil-rich layer.

The choice of support for a particular paint layer is very important, as problems will often occur if a thick inflexible paint or ground layer is applied to a thin flexible canvas or paper support with cracking as the result. The application of unstable surface coatings, such as polyurethane which discolours rapidly and becomes insoluble, will mean that the original tonal values of the work will eventually be irreversibly lost.

■ *Light*—accelerates the deterioration of paint mediums and can cause them to become chalky or crack. It can also cause the discoloration and crazing of varnish

Paintings

layers. Exposure to light will speed up the acid degradation of the canvas, non-archival cardboard, or particle board supports resulting in discoloration and embrittlement.

Paintings are vulnerable to fading from light, but because they usually have a thicker layer of pigment than works on paper, it takes longer for this to be noticeable. The heat generated by light can cause desiccation or contribute to the damage to paintings caused by fluctuating humidity levels.

Keep paintings out of direct sunlight or high levels of indirect sunlight. Artificial light sources should be kept at a distance to prevent heating, with light levels below 200 lux and ultraviolet less than 50 microwatts per lumen.

■ *Relative Humidity and Temperature*—fluctuations in relative humidity are particularly harmful as they promote dimensional instability in paintings. Differing reactions to changes in humidity by the various materials in a painting will result in stress building up between layers with possible bond failure. For example, while the canvas or wooden support swells and shrinks in response to fluctuations in humidity, the paint layer will change very little in size and as a result cracking and flaking can occur.

Excessive heat and humidity are other main causes of damage from the environment. Dryness can cause warping of cardboard, wooden supports and stretchers, and the cracking of paints. Dampness encourages mould growth and insects. It is important to note that paintings will have an extreme reaction to wetting, and cracking and delamination of the paint layer is a common result.

The ideal humidity level for paintings in New Zealand is between 50 and 60% relative humidity. Fluctuations should be kept to a minimum and damp areas or heat sources avoided.

■ *Mechanical Damage, Dirt and Stains*—paintings

must be handled carefully because they are surprisingly delicate. Movement in the support through flexing, sagging or vibration can cause a brittle oil paint layer to crack. A canvas support is particularly vulnerable to tears and blows which can crack and dislodge the paint. Paintings on cardboard, hardboard and plywood can easily be chipped around the edges.

Many contemporary paintings rely on very delicate surface effects. Acrylic paints are thermoplastic so they remain soft at room temperature and can be permanently soiled by handling. Other materials used to create chalky and waxy finishes are also extremely susceptible to damage from abrasion and fingermarks.

Paintings are most at risk when they are being moved, or are forgotten about in storage.

■ *Biological*—paintings can be damaged by animals, insects and mould. Insects such as borer can attack wooden supports, and canvas and cardboard supports are open to attack by silverfish. Insects can also attack proteinaceous materials in the paint layers such as glue-size or the egg in tempera. Fly or spider spots stain the paint

layer and become insoluble in the course of time. Mould can cause staining and weakening of the support, and will dull and discolour the paint layers.

Temperature control, good air circulation, regular dusting of the paint surface and other suggestions under Insects and Mould (see also page 5) are the best methods of prevention. There are very few fumigants suitable for use with paintings, so fumigation should be avoided unless specific conservation advice has been sought.

■ *Atmospheric Pollutants*—can cause damage to paintings. For example, hydrogen sulphide which is found in high levels in Rotorua accelerates deterioration in the organic components of pictures and can chemically change the colour of many pigments. Because paintings are often unprotected by glass, sticky



Paintings

residues from smoke and aerosols can cause a great deal of damage. Dust can become ingrained in the paint layer or attract water to the surface, encouraging mould growth.

Handling

Before moving an object, painting, or frame, examine it for damage. If damage exists, carefully collect and save any pieces, no matter how small. This practice will greatly assist the conservator.

If loose paint is present on a painting or polychrome statue, make no attempt to move or handle the piece. Instead, contact a conservator for advice and assessment of the damage. Paintings with lifting or flaking paint should be kept flat, paint surface up.

Paintings must be secure in their frames. If they are loose, do not move or handle them until they are safely fixed. Before hanging a painting, be sure its hanging devices are firm.

Do not handle, move, or carry more than one painting at a time. Large paintings should be moved by at least two people, regardless of the weight involved.

Never carry a painting by the top of its frame or stretcher. Carry with one hand on each side. Never put your hands between the stretcher bar and canvas as this can cause serious damage to the paint layer.

Do not touch the surface of a painting with hands or cloth. Avoid direct contact with painted surfaces at all times. Wearing white cotton gloves while handling paintings is always advisable; clean hands are not enough. Perspiration will damage both paintings and frames as well as fabric mats and liners.

Never apply tape or adhesive either to the front or back of a painting or to the visible parts of the frame. Do not attach labels or write on the back of a canvas painting.

Handle works of art as little and as infrequently as possible. Avoid home-restoration attempts, as you are very likely to cause irreversible damage. Leave conservation to the experts.

Remember that damage caused by careless handling frequently does not become visible for a considerable time. If the surface of a painting is bumped, it may be months or years before cracking and lifting of the paint surface appears.

Display

Paintings are traditionally framed for display purposes as this provides protection as well as enhancing the image. However the protective function must take priority over the decorative, or the frame itself can cause damage.

If the artist did not want the picture framed, then it will have to be hung from its support. Additional protection can be provided to unframed paintings on solid supports or solid auxiliary supports during transportation and storage by the use of travelling frames. These are attached to the back and have the same disadvantages as shadow frames (see also page 36). They provide protection around the edges and front surface by projecting out past the picture plane. Travelling frames can also be used to protect large ornate and delicate frames during transportation and when in storage.

Unstretched paintings on canvas are not normally framed and are intended to hang directly from the wall. Those with metal eyelets along the top edge can be hung from nails in the wall, but pinning or nailing directly through the canvas is not recommended as it can cause distortions and tearing. Velcro can be used to hang unstretched paintings, in a method similar to that described for textiles (see also page 43). A strip of Velcro is invisibly sewn or adhered to the top reverse of the painting, and the matching Velcro attached to a strip of wood or plywood that can be hung on the wall. A conservator can give advice as to the most suitable hanging method.

Framing

■ *General Points to Remember*—the frame must be substantial enough to hold the picture, and not so weak

Paintings

that the picture holds it. The painting should be rigid and not able to flex.

It is advisable to build up the back of the frame so that it is as deep as the painting and the reverse is protected.

The frame should project out past the picture plane so that when laid face down, the painted surface is not in contact with the table and is therefore protected from any abrasions or dirt.

■ *The Rebate*—or ‘rabbet’ of the frame is the lip on which the front of the painting rests. It should be slightly larger than the picture to allow for expansion either from environmental changes or from keying out of the stretcher.

To prevent the painting slipping around in the frame and to hold it in position, a material such as archival board, balsa-wood or corks can be wedged between the frame and the painting. These can be secured in the frame with gummed linen cloth tape or double-sided tape.

Measures should be taken to ensure that the front edge of the picture is not abraded by the rebate. It should be sanded down so that it is smooth and flat and then a protective material attached. Felt strips, velvet ribbon, or archival blotter can be adhered to the rebate with double-sided tape or PVA (allowing 8 hours to dry properly). An alternative is to attach strips of wood, metal or plastic to the edge of the picture so that they protrude beyond its face and keep it away from the rebate.

■ *Glazing*—with glass or acrylic sheeting is useful for added protection. It is especially good for pictures that have delicate surfaces or are to be hung in areas where they might get dirty or be touched. Museums often glaze paintings that are to go on loan.

If a painting is to be glazed, there should be a space of about 5 mm between the face of the picture and the glazing material. If the two layers touch, the paint could adhere to the glass/acrylic and be pulled off. A strip made of wood or balsa-wood can be used to separate the

painting and glazing and this should have a soft material over it, such as felt or velvet, to protect the picture. It may be necessary to paint the inside edge of the strip black so that it is not visible from the front.

Acrylic sheeting is often more practical to use than glass because of its resistance to shattering which is extremely important for travelling exhibitions. Acrylic also has better temperature insulating properties and some varieties filter out more ultraviolet light. Glass is much harder to scratch, doesn't attract dust to the same degree, has low thermal expansion and comes in low-reflecting grades (such as Image Perfect and Tru Vue).

Both acrylic and glass filter out some ultraviolet light, but enough will get through to damage paintings. The high ultraviolet filtering varieties can be useful for protecting delicate artworks but as some ultraviolet will still get through as well as other damaging wavelengths in the light spectrum, it is safest to keep within recommended light levels and exposure times.

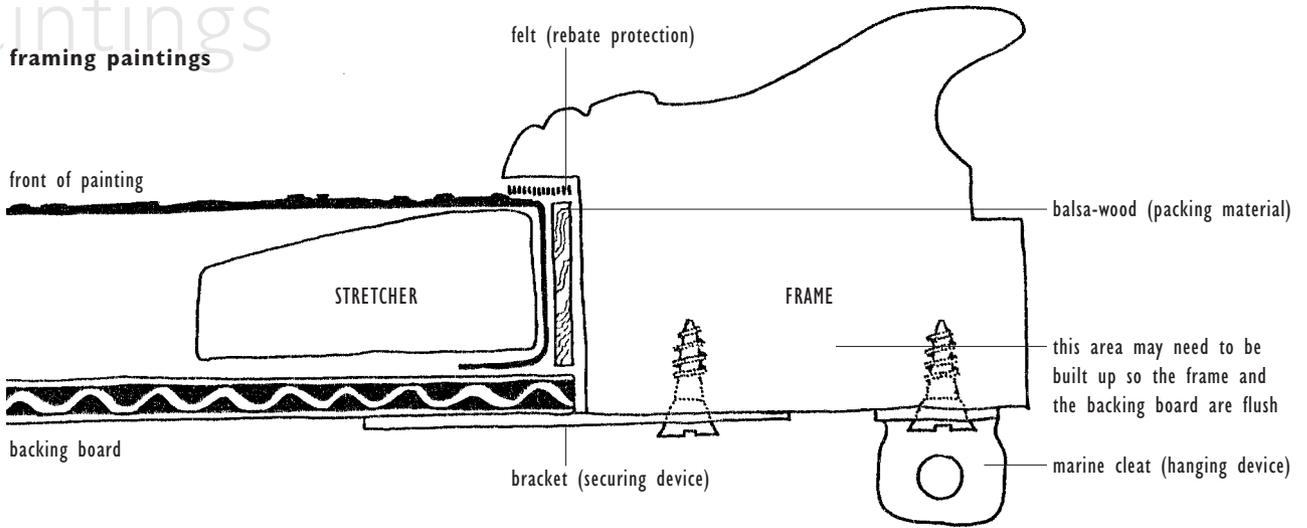
■ *Securing*—the picture should be properly secured in its frame. Nails should never be used as the hammering can cause damage through excess vibration and they can inadvertently go through the painting. Staples should not be driven into the painting to hold it in the frame as they can cause damage. Both nails and staples are extremely difficult to remove.

Metal brackets or mirror-plates which are screwed to the frame hold the painting in by pressure alone. They can be made of aluminium, brass, galvanised steel or any material that is strong enough and will not corrode. Every painting should have at least one bracket on each side (more if large) to ensure that it is securely held in the frame.

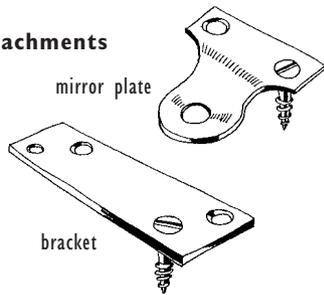
■ *Hanging*—it is preferable to hang a painting from its frame. The stretcher can be damaged by hanging devices and if it is supporting the weight of a heavy frame it can distort. It is advisable, especially with large works, to have two points of contact with the wall for better security. Marine cleats (JC1) are very good, as they are extremely strong and have a self-locking mechanism.

Paintings

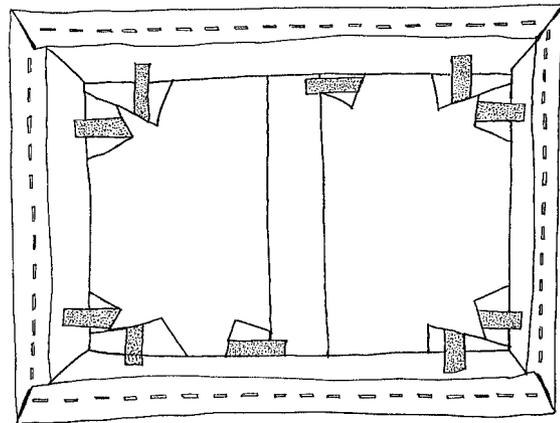
framing paintings



securing attachments

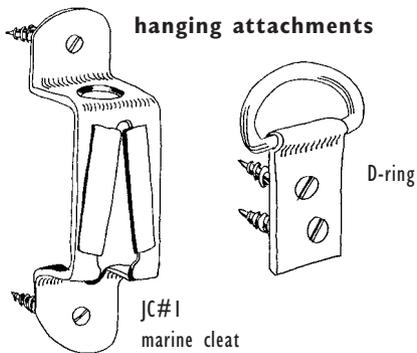


securing keys to the stretcher frame



rear view of painting, secured with masking tape

hanging attachments



Paintings

Other varieties of hanging mechanisms are available, such as D-rings or brass mirror-hangers. Nylon cord can be used for light paintings and if picture-wire must be used, then multi-strand is the strongest. Picture wire can cause damage by poking into the back of a canvas painting causing distortions and cracking.

■ **Backing**—backing boards should be used for paintings on canvas, and also for paintings on cardboard and wooden supports that are fragile or not sealed. Backing boards protect against blows to the reverse, dead insects, dust and other grime that often ends up between the canvas and stretcher beam. They provide a buffer against the environment, slowing the effect of temperature fluctuations, high humidity, pollution and light.

The type of backing that should be used depends on the picture and what is available. Archival and normal corrugated card can be used, as well as fluted polypropylene, foam core board, hardboard (heavy but strong) and even acrylic sheeting (very useful if you wish the reverse to remain visible).

Backing boards should be attached to the reverse of the frame (this can be facilitated by frame build-ups) by screws, Velcro and/or tape. Taping provides a better dust and environmental shield, and various types can be used such as double-sided, gummed cloth, aluminium tape and gummed paper. If it is not possible to attach the backing board to the frame and it must be attached to the stretcher, do not attach tape to the canvas, as this could cause damage if removed when the canvas becomes old and brittle.

A backing board is an excellent place for labels; in no circumstances should labels or inscriptions be put directly on the reverse of the canvas.

■ **The Frame as Part of the Art Object**—an original frame can be an important part of the work of art. The artist may have chosen it to complement or bring out something in the painting, and by removing it you could alter the artist's intent; or the frame may epitomise the age of the work, making it part of its history. Original frames should therefore be reused if at all possible.

■ **Shadow Frames**—a shadow frame is one that allows the edges of the painting to remain visible. This means that the painting will have to be screwed or glued to the frame from the back and cannot be held in by pressure alone. This is problematic because it involves permanently changing and possibly damaging the back of the painting. Thin supports such as hardboard are difficult to attach to this type of frame without glueing, making removal extremely difficult. An alternative is to glue Velcro to the painting reverse and frame to hold the two together. Never glue over original inscriptions. Paintings on thick paper are best framed behind glass like works of art on paper (see also page 14).

Storage

Paintings are safer on the walls than in poor storage facilities where they are more likely to be knocked, torn, and become dirty and mouldy. Basic requirements of a storage area are a good environment with stable temperature and humidity levels, no natural light and low artificial light levels, clean, with good air circulation. The storage area should always be kept separate from other activities to reduce the possibility of accidental damage. Other main points are listed below.

■ **Keep Paintings off the Ground**—paintings are best kept off the ground, primarily to avoid damage from flooding, but also to protect the edges. Paintings should either be kept in storage slots, drawers or screens for permanent storage, or on padded blocks for temporary storage. Padded blocks protect the base of the frame or painting and stop slipping occurring. They can be made of foam only, or foam on wood covered in cloth.

■ **Stacking Paintings**—paintings should be stacked with extreme care as damage to the artwork or frame is often caused by this method of storage.

Paintings should not be in direct contact with each other and should be protected by a solid barrier such as corrugated cardboard.

Do not lean anything against the front or back of a canvas painting as this can result in distortions, crack-

Paintings

ing and tearing. Special precautions should be taken with unframed paintings with delicate soft surfaces, as these may be damaged by the cardboard itself and may need a travelling frame to keep everything away from the surface. Nothing should be leaned directly against the front of a painting.

Paintings should be stacked vertically and placed face to face and back to back with corrugated cardboard sheets in between. This eliminates the danger of protruding decorations and hanging apparatus on frames damaging the faces of adjacent pictures.

Stack works of a similar size together. Put the largest work at the back, tapering to the smallest at the front. Adjacent pictures must be large enough to cross each other completely. Do not stack paintings that have fragile paint layers. They should be laid flat and conservation advice sought.

■ *Paintings should be Stored in Frames*—frames protect pictures from abrasion. If not framed or in a travelling frame, a painting should be wrapped in Tyvek (a synthetic paper) or clean soft tissue (preferably acid-free).

Keep tape away from the front of the painting. Wrapping paintings in clean tissue or Tyvek is advisable for those pictures with delicate surfaces, such as colour-field paintings or ones with bare canvas exposed. These types of pictures rely on surface effects and any damage can be difficult or impossible to treat, ruining the intended effect of the artist. Plastic can also be wrapped around these works if they are already wrapped in tissue.

Plastic, including bubblewrap, should never come in direct contact with the paint surface, as the two layers can adhere together or leave permanent marks on the paint surface. The painting should be wrapped in an acid-free tissue or Tyvek first and the bubblewrap should be wrapped with bubbles to the outside.

■ *Slot Storage*—frequently paintings are packed into slot storage units without any protection from the storage structure or the other paintings. The results are abrasion, scratches, scuffing, breaks and tears. These are all things that could have easily be avoided with a minimum of expense. Paintings should not be stacked together without a protective layer between them.

If you have a large number of paintings to store, then it is advisable to use a rigid structure for this purpose. Moving screens are useful for large collections, but they are expensive and therefore for smaller collections slot storage is probably more practical. Slots prevent too much pressure building up from large numbers of paintings leaning against each other. Slots are best made of sealed wood, having bases lined with

compact foam (such as expanded polyethylene) to protect frames and picture edges. Sheets of a rigid material such as corrugated card should be used to separate the paintings.

■ *Roll Storage*—unstretched canvas paintings can be stored on screens if they have eyelets or Velcro, but otherwise they will have to be stored flat or rolled. Paintings should not be rolled if they have a thick or brittle paint layer, collage elements, or delicate support.

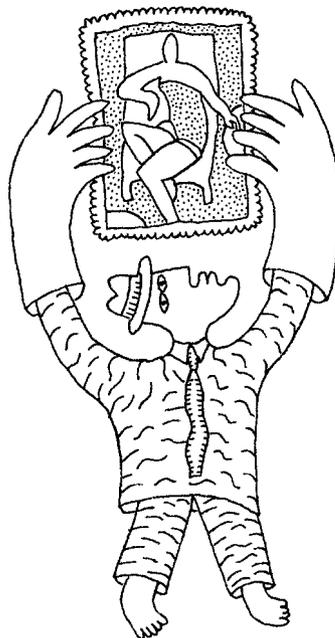
The Frame as Part of the Art Object

An original frame can be an important part of the work of art. The artist may have chosen it to complement or bring out something in the painting, and by removing it you could alter the artist's original intent; or the frame may epitomise the age of the work, making it part of its history. Original frames should therefore be reused if at all possible.

Paintings

The painting should be rolled firmly to avoid creases, with the painted side out on a large-diameter tube. The painted side should be rolled on the outside to avoid contraction of the paint layer which is likely to cause cracking over time. Rolling the painting on a large-diameter tube puts less strain on the paint layer and is less likely to leave distortions on the surface. The diameter of the tube depends on the size of the painting but should not be smaller than 200 mm and a large painting should be on a 400 mm tube or larger. The tube should be covered in an acid-free tissue or Tyvek, and these materials should be rolled with the painting to separate the layers.

The tube can be stored on padded blocks at either end (avoiding the painting) or suspended with a chain or pole through the centre of the tube.



Textiles / Basketry

Textiles and basketry encompass a wide field, from objects constructed from cotton, linen, silk, wool, fur, feathers and synthetic fibres, to kete and fishing/hunting equipment.

Causes of Deterioration

From the moment of manufacture, a textile or basketry object begins to deteriorate. Its condition on entering a collection will be dependent on how it has been used and cared for. There may also be inherent problems with the method of manufacture of the object which will cause the fibres to break down rapidly—dye techniques in the case of weighted silks and traditionally dyed black fibre in Maori weaving, for example.

■ *Light*—increases the rate of chemical breakdown in the fibres and dyes. A textile will yellow, becoming brittle, and dyes will fade. The effects of light are cumulative and irreversible, which means that once colours have faded and fibres have been damaged by light, they cannot be rejuvenated and any further exposure only adds to the damage. The ultraviolet portion of light, significant in daylight and in strong artificial light, causes the most damage.

■ *Temperature and Humidity*—fluctuations in temperature and humidity will accelerate deterioration of textiles and basketry. Mechanical damage is caused by the swelling and contracting of the elements within the



artefact. A high temperature coupled with high humidity will create an environment where mould growth is likely. High temperature and low humidity will cause a drying out of the elements, increasing their brittleness, leading to splitting and fracturing.

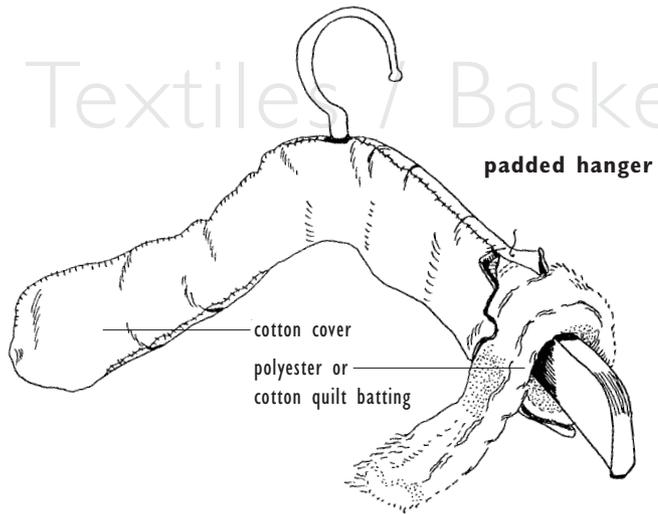
■ *Soiling*—dirt from the air or through past use, along with pollutants, accelerates the deterioration of a textile.

Together with the natural breakdown of its fibres and poor storage, soiling is a major factor in the tendency of a textile to become acidic. In a piece of costume, under-arm areas exposed to perspiration become acidic, as do any food stains down the front of the garment. These acidic stains and soil cause chemical changes to fibres, weakening their structure.

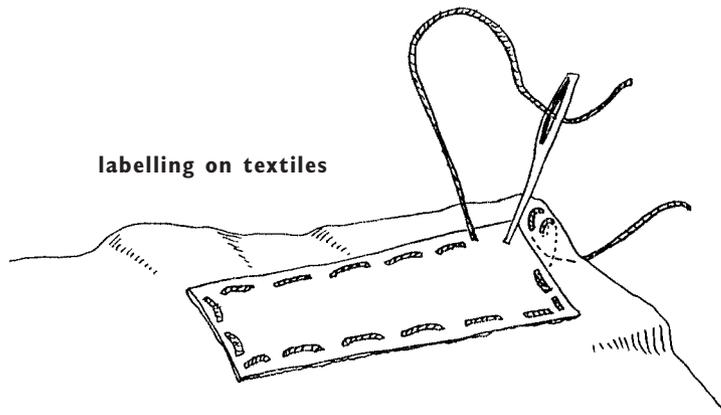
Soiling tends to be hygroscopic, holding moisture, increasing the chances of mould growth and insect attack. Dependent on the soil type, insects and rodents may be attracted to an artefact, causing considerable damage. Soiling can also be abrasive if an object is being handled or in an unstable environment. Where an artefact has come into contact with metals, rust staining can occur which breaks down the fibres, leading eventually to holes within the fabric.

■ *Pollutants*—are another source of damage. Metal threads, often found in textile artefacts, are vulnerable to sulphur—a particular problem for areas such as

Textiles / Basketry



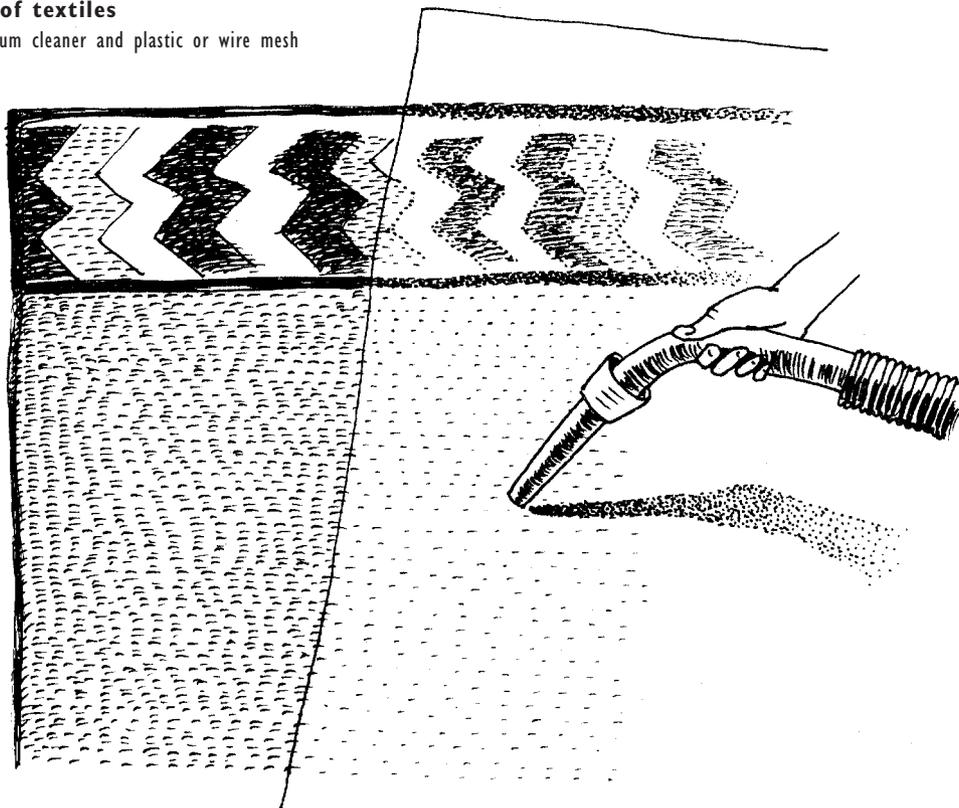
padded hanger



labelling on textiles

cleaning of textiles

using a vacuum cleaner and plastic or wire mesh



Textiles / Basketry

Rotorua, and where wool is prominent within a building. Other pollutants such as carbon from car fumes also increase the rate of deterioration.

■ *Biological*—insect infestation, fungi and moulds, as well as rodents and animals, can all cause considerable damage to textiles. The major insect pests to attack textile collections are carpet beetle, moths and silverfish. Carpet beetle and moths tend to prefer protein materials such as wool, silk, fur and feathers, while silverfish are more partial to cellulose fibres including cotton or linen. Mould and fungi grow on all fibres, weakening the structure, and may create stains which can rarely be removed.

Rodents have been known to make nests in artefacts as well as eating any likely food source such as a soiled textile. Animals such as cats and dogs can also damage textiles.

Handling

Improper handling can cause irreversible damage to textiles and basketry. Unnecessary handling should be avoided and the artefact should not be pulled or dragged. It is recommended that white gloves are worn when handling textile objects. These should be clean and changed regularly if any soiling is apparent. Plastic gloves should be worn when handling basketry to avoid snagging fibres on the surface of the artefact.

Support the textile fully when lifting to avoid stress on the fibres and seams. Baskets should also be fully supported—do not assume the handle or rim of an artefact is strong enough to hold its weight.

Place the artefact to be examined on a prepared clean flat surface (washed sheets are ideal). To avoid unforeseen accidents, do not smoke, eat or drink near objects. Only pencils should be used while examining the artefact.

Accession numbers should be written onto cotton tape before sewing to a textile.

Three-dimensional objects should be padded out to protect them from creasing. Avoid storing basketry

objects inside one another or balancing them on their sides.

When mounting costume for exhibition, it is almost always necessary to have two or more people involved for the safety of the object.

Any loose dirt should be removed using a low-powered vacuum cleaner through a plastic mesh screen. The nozzle should be held slightly off the surface of the artefact. A soft brush may be used on basketry objects if the surface is not too dry or friable. The nozzle of the vacuum cleaner should be covered with net and used with the brush to lift and remove surface soiling from the interstices of the weave. Any further cleaning should be referred to a textile conservator.

Storage

Improper storage can cause permanent damage to an object. Storage on a wooden shelf or drawer, or wrapped in acidic paper, will increase the acidity of the textile, often leaving a yellow stained area which becomes weak and brittle. A hot-water cupboard will dry an artefact out, increasing the rate of deterioration and causing it to become brittle.

Plastic bags, adhesive tape, staples and pins should be avoided. Heavy pieces of costume such as beaded dresses should not be hung, as they will distort and stress will be placed on the load-bearing areas. Textiles should be clean before storing, but seek professional advice on cleaning techniques.

Correct storage will help to extend the life of an artefact and reduce the risk of damage. The storage area should be dark, with lights only in use when artefacts are being retrieved from or returned to storage. Temperature and relative humidity levels should be kept constant at around 20°C and 55% relative humidity respectively.

Protect artefacts from dust and light in acid-free boxes, fabric bags or clean acid-free card-lined drawers. Acid-free tissue should be used to wrap and pad textiles.

Check stored artefacts regularly for signs of mould growth or insect infestation.

Textiles / Basketry

Storage units can be constructed from wood or metal. The metal shelving should be baked enamel on steel to prevent corrosion products coming into contact with the artefacts. Wood should be sealed with a moisture-cured polyurethane to prevent organic acid vapours being emitted.

Three basic techniques are generally used to store textile-related artefacts: flat storage, handling storage and rolled storage.

■ *Flat Storage*—two-dimensional fabrics and many types of fibre artefacts can be stored flat, without folds, in drawers, on shelves or in boxes. Costumes can also be stored flat if all the creases and folds are padded out with acid-free tissue, including sleeve and bodice areas. Three-dimensional artefacts such as shoes, hats, baskets and upholstered furniture should be stored on flat shelving, or where size permits, in boxes.

Shoes, hats and baskets should be padded out with tissue where necessary and along with upholstered furniture, covered with a dust cover.

Boxes, shelves and drawers should be clearly labelled to avoid excess handling of artefacts.

■ *Hanging Storage*—light pieces of costume in good condition may be hung on a padded coat hanger. Padded coat hangers can be constructed from coated wood or metal hangers covered with a wadding material, such as polyester wadding (eg Dacron), finished with a washed cotton fabric. The costume should be hung on the hanger with fastenings closed. Cotton tape tabs, long enough to tie on the hanger, may need to be stitched to the waist seam of some dresses to support the weight of

the garment. The garments should be individually covered with fabric bags and well labelled to prevent unnecessary handling.

■ *Rolled Storage*—flat, unlined, undamaged textiles can be rolled onto ample-sized rollers. The plastic or cardboard tube should be covered with aluminium foil

before wrapping in tissue, or padded out with polyester wadding covered with calico. The textile, with right side out, should be interleaved with tissue as it is rolled.

The rolled textile should be wrapped in either more tissue or cotton fabric and secured gently but firmly with cotton tape. The roll should be well labelled to prevent unnecessary handling.

The rolled textile must have a support system which ensures that no weight is placed on the textile. A rod can be passed through the centre of the roll and its ends suspended on a cabinet frame-

work or on a chain system. The unused ends of the roll could also be used to hang the roll by placing them on blocks on a shelf, ensuring the textile does not come into contact with any surface.

Display

Careful display of an historic textile will help to ensure its long-term preservation. The same control of temperature and humidity, protection from dust, dirt and insects used in storage must be practised while a textile is on display. A display case is recommended to protect the artefact from dust and handling by the public. Low-level ultraviolet-filtered artificial lighting should be used for display.

Storage Recommendations for Textiles

Flat storage in acid-free boxes preferred for all textiles.

Hanging storage on padded hanger for strong and light costume pieces.

Rolled storage on padded roller for flat textiles.

Textiles / Basketry

Objects should be exhibited for short periods only (approximately 3 to 6 months) If, however, the textile is part of a permanent display it should be rotated with other examples from storage.

It is important to protect the object from any heat sources, such as heat from lighting fixtures. It is also advisable not to display artefacts against a damp outside wall.

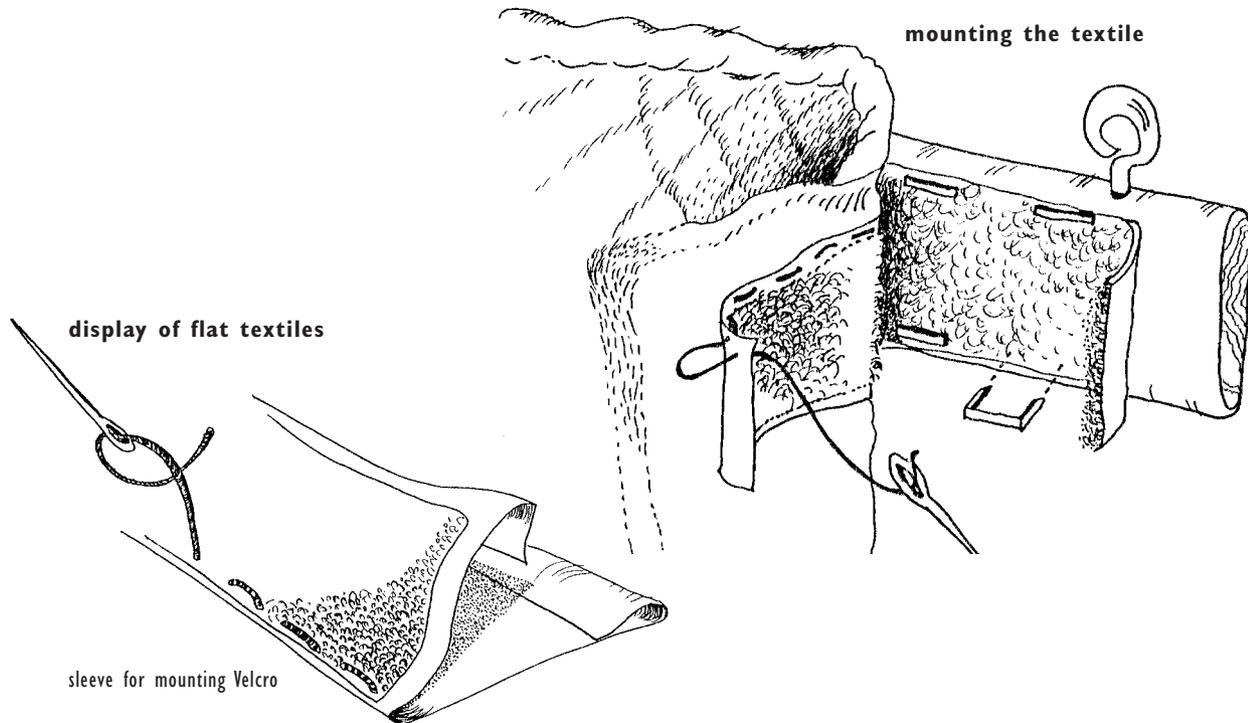
Display techniques should not damage the artefact in any way. Textiles should not be suspended from curtain rings or hung by tacks, pins, adhesive tape or glue. A loop Velcro strip stitched to cotton tape prior to being stitched to the top back edge of a textile to be hung will provide even support. The hook portion of the Velcro should be attached to the back of the display case and

the textile hung from the centre out to the edges.

Tapa cloths can be displayed hung over a padded roller.

All materials in contact with the artefact should be acid-free. Any wood used in the construction of display cases should be sealed with an acrylic paint or moisture-cured polyurethane and well aired before being covered with a suitable material on which the artefact is to be displayed.

Strong costume items including piupiu and cloaks can be displayed on dress forms provided adequate support is given to the object. It is better to start with a dress form slightly too small and pad out with acid-free tissue than to try and fit costume onto a form that is too big.



Wood

Wooden objects range in size from small boxes to large canoes. In many cases they are not solely made of wood, but include materials such as metals, glass, shells, feathers, etc. When caring for artefacts made of a variety of materials the preservation requirements of each must be taken into consideration and if necessary compromises made to ensure the overall preservation of the object.

Causes of Deterioration

Extremes of temperature, fluctuations of humidity and biological attack are principally responsible for the deterioration of wood. This applies equally to carvings, and ornaments such as combs, artefacts such as digging-sticks, bailers, weaponry, canoes, and furniture.

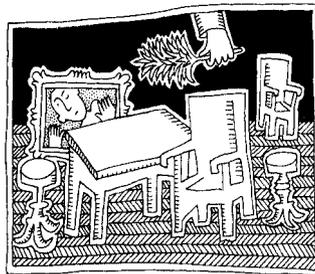
■ *Temperature and Humidity*—extremely hot and dry conditions will cause wood to shrink and crack. Alternatively, cold and damp conditions will cause wood to swell and warp. Sudden fluctuations in temperature and humidity will accelerate these processes. For example, wooden items obtained in moist tropical regions and transported to drier countries commonly develop serious cracks as moisture is lost from the wood. This can be seen in collections brought back from Melanesia by missionaries in the 19th century, and in modern-day

carvings from Papua New Guinea. Similar damage may occur if items composed of wood are exposed to hot sunlight during the day and to cold conditions at night.

■ *Biological*—wooden artefacts in museums are particularly susceptible to attack from the common house borer and, to a lesser degree, the New Zealand dry-wood termite. Fumigation with methyl bromide is an efficient method for dealing with borer, but this can only be carried out by registered pest controllers and is soon to be banned in New Zealand. Do not use home-made remedies as these can grossly discolour wood without necessarily eliminating the pests. In some cases borer infestations

will be restricted to a small part of an artefact and this can be treated with a commercially available pesticide. Before using such a product contact a conservator for advice as to whether it is the appropriate treatment for your infested artefact.

Surface moulds such as mildew and wood-rotting fungi are potentially destructive to museum collections and to buildings. They thrive in damp and unventilated conditions. Carvings are particularly susceptible to dry rot and should be inspected regularly to see whether old infested areas are still dormant and that new growths haven't developed (see also page 7).



Wood

Handling

Do not alter decoration finishes on carvings. Maori carvings were once painted red or black by museum staff in the misguided belief that they were recreating the original appearance of such pieces. If a carving is unpainted there is no justification in assuming that it was once painted. Similarly, carvings with old paintwork on their surfaces must not be 'touched up'. Painted carvings must not be stripped of paint until a thorough investigation into their history has been completed. Only then can it be decided that a particular paint finish is inappropriate, and can therefore be removed by trained conservators.

Often in areas where land drainage is being carried out, waterlogged carvings are excavated. Whenever possible keep the find in very damp conditions or, if size allows, put the carving in a water bath. Do not attempt to treat the artefact yourself but contact a conservator. Do not use linseed oil or commercial furniture polishes containing oil on wooden artefacts. Oil collects dirt and builds up grimy layers on the surface of the wood.

Do not use silicone waxes and polishes, as once they are applied they cannot be removed, and therefore permanently change the original finish.

■ *Advice on Furniture*—do not carry chairs by the top rail, heavy pieces (such as desks, heavy tables and sideboards) by the top, or upholstered pieces by the arms. Instead, pick them up by the frame, seat rails, or bases.

Do not move heavy pieces without covering them to protect against bumps, scratches and rubbing. Rubbing against painted surfaces can embed paint in the finish; this is very difficult to remove and can cause permanent damage.

Use all floor-cleaning equipment with care. Much damage is done to the bases (legs, feet, bottom rails) of furniture through improper use of such equipment.

When painting walls or woodwork where the furniture cannot be moved out of the room, do cover it completely. A surprising amount of furniture which comes for conservation has dry, hard paint splatters on the fin-

ish. If the furniture is damaged, keep any part that has been broken off. Put it in a labelled container as this will assist in the conservation process.

Furniture should not be placed in direct sunlight. This will cause fading and deterioration of finish and fabric. Do not attach stick-ons, masking-tape or any other gummed tapes to the finish. They are difficult to remove and may cause damage.

Linseed oil mixtures should not be used as a polish. You will eventually get a build-up of oils which collect dirt and darken the finish.

Do not apply wax to unfinished wood. Wax is not a finish itself; it is a protective coating to be used over a finish. Once wax is applied to the wood it is very difficult to remove and will discolour with age. Wax should not be applied over a dirty finish; clean it first. When a finish becomes worn and dull, and will not shine when buffed with a hard cloth, do not re wax.

As with other wooden items, regularly check furniture for insect infestation, mould and mice (see also page 6).

Storage and display

Before bringing new artefacts into the storage area, check for insect infestation such as borer-holes and, if necessary, arrange treatment.

It is important that wooden items, whether on display or in storage, be kept in a mild environment. Ideally, conditions should be maintained at about 20°C and between 50 and 60% relative humidity. It is possible to avoid temperature and humidity problems by taking reasonable precautions. Wooden objects should never be placed in direct contact with outside walls or cold and damp floors with no air circulation. Lighting should be kept to a minimum, and wooden items should never be left in direct sunlight.

Display techniques should never damage or permanently change a wooden artefact. If problems are encountered with the display of a particular artefact, consult a conservator.

Bone / Ivory / Teeth

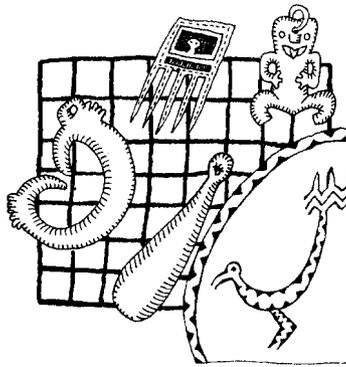
Although bone, ivory and teeth differ in colour, grain, texture and hardness, their chemical composition is similar and they react in a similar manner to different environments. All consist primarily of inorganic materials which provide rigidity and strength, and an organic component, which has the capacity for growth and repair. The difference is that bone has tiny blood vessels which extend through a central spongy marrow, and ivory and teeth have no blood marrow or blood vessel system. Ivory and teeth are usually harder, denser and whiter than bone.

These materials have been used to make a variety of artefacts including tools, weapons, jewellery and painting supports.

Causes of Deterioration

All of these materials are reasonably durable, although they can be easily damaged if improperly cared for.

Bone, ivory and teeth, like wood, are hygroscopic materials. This means that they will absorb and release moisture with fluctuations in humidity, swelling or shrinking as the humidity levels change. Fluctuations such as these can cause severe cracking and warping and, in particular, affect ivory objects such as supports for miniatures. It is therefore important that steady



humidity and temperature levels are maintained and extreme conditions avoided. These materials should be kept away from direct sunlight, hot light sources, strong air currents, exterior walls or windows.

Bone, ivory and teeth are also very susceptible to staining from sulphur, metals and coloured materials.

Handling

Gloves should be worn when touching these materials. Fragile material

should be supported on padded blocks so that movement is possible without any direct handling of the object itself.

Display and Storage

Strong light, particularly daylight, should not be present. When considering mounts for display purposes, rubber pads and adhesives should not be used near ivory as the sulphur can cause stains. Similarly, contact with iron, copper alloys and coloured materials should be avoided because they too can stain. Ivory supports for miniature paintings should not be glued down to backings; this will cause stress as the support tries to adjust to differing temperatures and humidity changes and could lead to cracking. Storage and display areas should be well ventilated.

Ceramics / Glass / Stone

Generally a ceramic will have a clay body, often with a glaze applied to the surface to decorate or waterproof it. The glaze is a layer of glass fused to the clay fabric. Like glazes, glass is composed of silica, fluxes and colourants. It is an amorphous structure which means that although it is a solid, it is not crystalline and the atoms are arranged as in a liquid.



Causes of Deterioration

Ceramics, glass and stone are susceptible to damage from changes in the environment. Fluctuations in humidity levels can cause salts in ceramic and stone objects to alternately dissolve and recrystallise, thus setting up stresses which may result in cracking or flaking.

The crizzled surface on some old glass objects is the result of the glass reacting with the moist atmosphere. Some old glass objects can be easily damaged by even slight changes in the environment.

Because ceramics, glass and stone expand with heating and contract when cool, temperature fluctuations accelerate their deterioration by building up stress through constantly changing dimensions. This can also cause cracking or flaking. These materials, therefore, should not be exposed to hot lights, sunlight or heaters.

Ceramics are probably one of the most stable forms of decorative artefacts and there is really no reason that they should deteriorate except in unusual situations.

However the most common form of damage to ceramics and glass is the result of mechanical shock upon impact, caused by direct or indirect human intervention. Breakage, scratching or abrasion can occur as a result of handling, storage, packing and display.

Atmospheric pollution, such as high concentrations of sulphur dioxide, can cause damage to these materials through acidic action on the surface. Particulate pollution can disfigure ceramics and marble either temporarily or permanently, depending on the degree of penetration.

Handling

Eliminate all unnecessary handling. This extends to routine washing and dusting. Try to arrange storage so that dust and dirt does not settle on objects. Remember, if you don't have to handle the object the most common cause of damage is eliminated.

Inspection of an object to verify its marking, hallmark or signature, generally located on its base, can often be eliminated with a photocopy machine. A reproduction can be kept with the object's folder.

Prior to handling, try to determine the nature and extent of mends, rebuilds, replacements and fills. Never pick up an object by a protrusion such as a spout, handle or attachment. Repairs most often occur in these areas.

Ceramics / Glass / Stone

Make certain your path is clear prior to moving an object. Never walk backwards while carrying a museum piece.

When you must handle or move an object, use clean, dry hands. The surface of most glass and ceramic objects is smooth and slippery, and the frequently recommended white gloves have a tendency to slip.

Remove lids and loose parts prior to moving. Small objects transport well in a padded box or basket with a handle; larger objects should be transported on a padded cart or dolly.

For cleaning, do not immerse pieces in warm water, as some old adhesives come apart.

Never use epoxy resin or super-glue to repair your broken pieces, as it discolours and is virtually impossible to take apart. For such repairs, seek the advice of a conservator.

Storage and Display

Ceramics and glass should be displayed in a stable environment and extremes of temperature or heat should be avoided. Lighting for display cases should be external so as not to cause heating of the objects.

Care should be taken to ensure that the artefacts are displayed or stored in a secure manner to avoid breakage or abrasion. There should be no

vibration which would cause damage by wear or creep, causing the object to move gradually to the shelf edge. If necessary the shelf edge could have a lip or band of material attached to it for safety purposes. In storage, small objects that are inclined to roll should be restrained from doing so with wedges of foam or tissue.

Stacking flat objects such as tiles, plates or plaques should be avoided as this will increase stresses, increasing the possibility of accidents and inhibiting accessibility. If space is limited and there is no alternative then only objects that are sound and stable should be stacked with layers of padding (tissue or foam) between them.

The interior of the display case or storage unit should be easily accessible to facilitate removal or installation of objects. Ideally, retrieval should not require the movement of artefacts over the top of others. But if this is necessary, then objects should be stored according to their size with the smallest at the front.

Display cases should ideally be constructed of inert materials such as metal and glass that will not emit any harmful corrosive vapours. If glass is to be used it should be laminated rather than toughened to avoid any risk to the contents of the case should the glass be broken.

Ceramics, glass and stone should be covered in storage to prevent dust settling and, where possible, displayed in a dust-free environment. Display cases should be as airtight as possible to reduce the impact of outside environmental changes and to slow the entry of gaseous and particulate pollutants.



The most common form of damage to ceramics and glass is the result of mechanical shock upon impact, caused by direct or indirect human intervention.

Metals

The preservation of metals is a very complex field. Metal artefacts are made from a wide variety of elements and these are prone to many deterioration processes. Except for the basic cleaning methods mentioned here, it is inadvisable to treat metal artefacts yourself and professional advice should be sought.

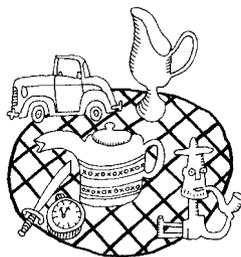
Causes of Deterioration

High humidity is one of the greatest causes of deterioration of metals as it aids chemical degradation. Atmospheric pollution is also a cause of deterioration for some metals (such as silver which, in Rotorua, is invariably tarnished by the naturally high content of hydrogen sulphide in the atmosphere), and lead-based metals, such as pewter, which are attacked by organic acid vapours. Chlorides (such as salt from the sea) cause an especially destructive type of corrosion process, known as bronze disease, to affect copper and its alloys.

Cleaning of metals also causes some deterioration, as many polishing solutions are abrasive and remove metal particles. Because of this, polishing should not be done too often. It may be necessary to coat the metal so that tarnishing does not occur.

The metals most likely to be encountered in New Zealand are iron and its alloys, silver in various forms, and copper and its alloys.

■ ***Iron and its Alloys***—iron in its various forms is



readily attacked by oxygen, in the presence of moisture, to form rust.

Iron objects should be carefully examined to determine the extent of deterioration and whether the corrosion is still active. Objects showing signs of active corrosion need specialised conservation treatment.

The surface of iron artefacts may be covered with a mixture of dirt, grease and loose rust; this will not provide an effective bond for coatings applied over it. Such deposits can be cleaned by a trained conservator using mechanical or chemical techniques.

Surface coatings help prevent further corrosion and therefore great care has to be taken in selecting and applying the appropriate coatings. Home remedies against rust and metal corrosion more often than not hasten the deterioration of the artefact rather than inhibit it.

■ ***Silver***—unless they are kept polished, silver artefacts will gradually tarnish with a layer of black silver sulphide. To remove tarnish, use a commercially available silver dip such as Goddard's. To avoid retarnishing, a protective coating has to be applied. Waxes or lacquers can be used as coatings. Waxes are easier to use, as a single break in a lacquer coating can allow corrosion to recur and the entire layer must be removed before another coating is applied. Wax coatings can be reapplied over

Metals

the top of each other without removing the entire original layer. To choose a suitable coating get professional advice.

■ *Copper and its Alloys*—copper has been used in its pure form and in combination with other elements forming commonplace alloys such as brass (copper and zinc) and bronze (copper and tin).

The types of corrosion products formed on copper and its alloys depend on the metal composition. The most common corrosion products are copper oxide, copper sulphate and copper carbonate. These are stable and protect the underlying metal from further corrosion. They are sometimes produced artificially to provide the attractive green-brown patina on bronzes. This patina, whether natural or induced, should never be removed, as it is part of the antiquity of the object. Bronze and copper objects with a patina do not require protective coatings unless they are displayed outside.

To maintain a clean, unpatinated surface such as might be required on colonial domestic ware and maritime artefacts, regular polishing is needed. To avoid frequent polishing, such artefacts can be given a protective coating such as described in the section dealing with silver.

Handling

Perspiration from fingers and palms can initiate the corrosive process, so it is very important to wear gloves. Always support a heavy artefact by the base when handling.

Storage and Display

Metals should be stored in as low a humidity as possible; 35% relative humidity is the recommended international standard. This is almost impossible to achieve naturally in New Zealand, but showcases or storage cupboards act as reasonably effective humidity buffers in themselves. For a more controlled low humidity, the commercially available desiccant silica gel can be used in showcases or small cabinets. The ratio of silica gel to volume of air contained in the showcase is a precise one and this information can be provided by a conservator.

Because of their sensitivity to organic acid vapours, lead-based metals should never be stored in oak cupboards or drawers or in wooden containers that have been adhered together with adhesives based on polyvinyl acetate.

Copper and its alloys should be kept away from chlorides (such as common salt) to prevent bronze disease. Metals should not be subject to fluctuations in temperature because of the rapid expansion and contraction this causes.

For permanent storage, silver objects should be wrapped in acid-free tissue paper and then in silver cloths to prevent contamination from the atmosphere.

Plastic

From Barbie dolls to spacesuits, plastic is found in an increasing proportion of materials in museum and private collections today. But the problems associated with the preservation of these complex materials are many.

Plastics are made from long-chain molecules or polymers that are normally organic; that is, the chain is composed mainly of carbon atoms. Although polymers exist widely in nature in, for example, wood, leather, horn and parchment, the use of modified natural polymers, new polymers or synthesised naturally occurring polymers has resulted in a wide variety of new plastic materials.

Plastics are divided into two main categories, thermoplastic and thermosetting. Thermoplastics are normally shaped by heat and pressure and will soften and flow if reheated. Thermosetting plastics are hard and often brittle compared to most thermoplastics, although there are exceptions such as polystyrene, which is a hard brittle thermoplastic, and rubbers, which are a special class of thermosetting polymer.

Causes of Deterioration

Most plastics are inherently unstable in the long term and their life will be considerably reduced if they are kept under the wrong conditions. As it is not possible to



eliminate all the causes of deterioration to plastics, it is necessary to control exposure to these factors.

Identification of the type of plastic and regular inspection of its condition will enable some of the causes of premature deterioration to be avoided.

■ *Light*—is damaging to all plastics and should be excluded or kept to a minimum. Even if the ultraviolet component is removed, light levels should be kept as low as possible. Light can cause yellowing or changes to the colourant and well as initiate chemical deterioration of the structure.

lowing or changes to the colourant and well as initiate chemical deterioration of the structure.

■ *Relative Humidity*—most plastics absorb moisture to a certain degree and so the maintenance of a stable humidity is important to prevent the building up of internal stresses.

Cellulosic materials, such as cellulose nitrate and cellulose acetate, should be kept at a low relative humidity, ideally below 40%, because moisture is a major factor in their deterioration.

Materials such as casein and nylon, because of their high moisture content, become brittle and subject to stress if the humidity levels become too low; they are better kept at around 60% relative humidity.

High levels of humidity should be avoided to slow the acidic by-products of deterioration and prevent mould growth.

Plastic

- *Temperature*—as heat will accelerate deterioration processes, a stable temperature that is not allowed to exceed 20°C is recommended. High temperatures should be avoided because they cause many plastics to soften or even melt.

- *Stress*—such as that imposed by stretching and bending can increase the rate of deterioration. Cracks will tend to appear as a result of the applied stress as is commonly seen along a fold and tearing can result from stretching.

- *Dirt*—thermoplastic materials remain soft and so are particularly prone to permanent soiling from dirt becoming ingrained in their surfaces.

Handling

Wear gloves when handling plastics. Provide adequate support for the entire object and avoid creasing or stretching.

Display and Storage

Certain plastics emit gaseous degradation products which may affect other parts of the object, or objects in the vicinity. For example, cellulosic materials and polyvinyl chloride emit acid degradation products which accelerate deterioration and can initiate corrosion of

metals. Ventilation of these materials is very important, and in some cases isolation may also be necessary to prevent damage to other materials.

Plastics should be displayed in display cases (with adequate ventilation) and covered in storage to protect them from dust.

Plastic objects should be displayed in a way that supports their correct shapes and prevents stress. Plastic surfaces should not be left in contact with one another or with other surfaces as they can become sticky.

Light levels for display should be kept below 150 lux and ultraviolet light should be screened out.

In general, plastic objects should be stored in cold, dark, dry conditions. Oxygen-free storage is recommended for particularly valuable objects. This is possible through the use of oxygen scavengers such as Ageless. The object is placed in an airtight bag with sufficient Ageless packets to reduce the oxygen level and thereby slow oxidation. Please consult a conservator about this method.

Otherwise most plastic materials will benefit from storage in a frost-free deep freezer or cold room which will slow the natural processes of deterioration. In this case, the objects should be placed in sealed glass or airtight plastic with colour-indicating silica gel.

Packing / Handling

These two functions cannot be separated. There is no procedure, apart from possible conservation treatment, in which an object is handled more than at the time of packing and unpacking.

It is a time of risk, and demands a high degree of skill on the part of the packer. It also requires acute observation, together with some knowledge of the wide variety of media encountered in museum collections.

Historically, this task of unpacking/packing was regarded as an inferior occupation within the museum hierarchy, and was often performed by the latest addition to the staff as a kind of initiation or apprenticeship exercise. The result of such non-supervised handling was a disaster, and caused much damage to our collections.

It was in the 1970s that New Zealand saw a great increase in the number of touring exhibitions, both national and international. These demanded above all else immaculate practice in handling, packing and installation techniques.

■ *Training*—the demands of an ever-increasing programme of travelling exhibitions put a great strain on the resources of any institution. In order to prevent damage to the collections or to items for exhibition, it is essential to establish regular training programmes for all staff in the disciplines of handling and packing.



These should ideally include everyone from curator to office staff, custodians and carpenters. It is another way in which all staff can identify with the organisation of exhibitions and learn the principles of preventive conservation. Training should be specific to ensure that people are aware of the characteristics of the

materials and packing techniques.

In smaller institutions, it is often a question of 'all hands on deck' in response to the pressure of a large touring exhibition, and everyone in the building may be involved in handling exhibits. All staff need to be trained to fulfil these demands when they arise.

For private collections, it is possible to safely pack single objects for short journeys as long as the objects are in good condition and carefully handled. If in any doubt, please call a conservator for advice. If the objects have to travel long distances or they are delicate or particularly large, it would be advisable to employ a packing expert to do it for you (see also page 65).

■ *Planning*—the planning of all touring shows must provide sufficient time for the packing/unpacking and installation of an exhibition. Too often the swift turn-around of travelling exhibitions sees unsafe practice due to haste. These practical problems need to receive the proper attention in the initial curatorial planning stage.

Works of art and artefacts should travel only if they

Packing / Handling

are in good condition or otherwise more damage may occur. A written and photographic record of the condition before transportation is advisable.

It is usually safest to transport paintings by the fastest mode of transport; that is, by air. By avoiding delay, it is possible to reduce the time the object may be exposed to vibration, an uncontrolled environment, or the possibility of accidental damage.

Remember to fully insure works of art or artefacts for the period of their transportation.

■ *Procedure*—the actual task of packing should be, and can be, immensely satisfying. The examination of an object for its condition report is an opportunity to learn about its uniqueness and should be relished. Each package should bear witness to this respect and present itself insofar as possible as a beautifully finished article. This encourages a sense of pride in the packer and a greatly increased sense of responsibility in the receiver. Special attention to the application and legibility of labels is an important part of this, as are instructions for unpacking.

Working in pairs is essential—preferably a senior, experienced member of staff with a junior, as this provides the ideal training in museological practice. Documentation of the object's physical condition by the one and the physical disposition of the object by the other will avoid confusion, and by checking and double-checking, ensure safety.

Always consult a conservator to find the appropriate, safe, packing materials to use for the different artefacts you are processing. Each category has its specific requirements. If contemplating long-term exposure through use in a touring exhibition, determine the physical condition of the object with regard to the rigours of such an exercise.

■ *Principles of Packing*—a package should protect a work of art by providing:

- A physical barrier (for example an exterior casing of wood or cardboard).
- Shock absorption (for example Evazote, Cellaire, Ethafoam, polyurethane foam). The method of closing or

opening the package should not cause vibration and nails or staples should never be used to secure a crate or box lid. Screws are commonly used for this purpose.

□ A moisture barrier (by painting the exterior of a crate, plus lining the interior with polyethylene or building insulation paper; or wrapping bubblewrap or polyethylene around the outside of a corrugated cardboard box).

□ Thermal insulation (by lining the inside of a crate with building insulation paper; it is also achieved through the buffering effect of the other packing materials).

□ A clean and isolated environment. The package should be sealed off to prevent dirt entering and to reduce the impact of the exterior environmental conditions.

■ *The Workspace*—the provision of a clean workspace for the packing/unpacking of works of art must be a high priority in all institutions. It must be a secure space, accessible only to the staff, not the public. In dealing with touring shows, it is often the exhibition space itself which is converted for this purpose of unpacking the exhibition or for its repacking at the end of the showing.

The basic requirements of the space are that it be a clean and well lit environment—a well organised space with designated safe areas for the objects waiting to be packed and a separate area for the waiting cartons or crates. Space for the packing materials is required, together with an area to receive the finished and sealed boxes or crates.

Well spaced padded trestle tables for each pair of workers is required, with trolleys, cushions, tools, waste-bins and gloves needed for the particular exercise.

Only one crate or box should be unpacked and processed at a time, which means only one object on a table at any one time. If a rather complex or unusual method of packing has been used, then a photograph, ideally a Polaroid for instant record, needs to be taken to record the exact disposition of packing in the box or crate.

Packing / Handling

The now empty carton or crate, with all its packing materials carefully reinstalled, must be resealed and stored at another location. Crates and boxes now empty can be stacked to minimise space requirement.

■ *Temporary Storage*—any framed works awaiting packing must either be stored in a slotted storage area or rest on padded blocks against the wall to raise them from the floor. All protruding hanging devices must be removed and boards used to separate works if stacked. No more than three works of similar size should be stacked on blocks at any one time.

Smaller items waiting to be packed must be safely assembled with soft sandbags or cushions between them, inhibiting any movement and so preventing damage by their falling against each other.

■ *Trolleys*—are the safest method of moving works of art within the building. They can be designed to carry all types of objects: paintings, sculpture, furniture, small decorative art objects and works on paper. They are the most useful tool that any institution can provide. It is far safer than transporting by hand as the object can be cushioned and secured to prevent any movement.

Packing Small Items of the Decorative and Applied Arts

These rules and methods of packing can apply to objects in ceramic, glass, stone, ivory, bone, teeth and metal for a travelling exhibition or short-term storage.

■ *Packing with Boxes*—in many cases, the most effective method of packing small works is to box them. Suitable box sizes can be determined once the dimensions of all items to be packed have been recorded (a number of commercially produced cartons are available in New Zealand). It is advisable to reduce the number of sizes used to two or three which will accommodate all of the objects. These, because of their modular form, can (when packed) be stacked and strapped together, or crated in containers built to accommodate their particular multiple dimension.

□ Pre-assemble the cartons required—often one to each object, stacked in order of size for ease of retrieval.

□ Assemble the objects to be packed in a safe place adjacent to the packing area where they will be collected as required by the packers.

□ Objects may require soft sandbags or pillows between them in order to prevent accidental damage during this holding period.

□ There must be a supervisor to oversee the whole exercise, to answer queries and to superintend the safe flow of work.

□ Trolleys with cushions should be used to move objects from the assembly storage point to the work-table.

□ When documentation and packing is completed and the carton sealed, the clear labelling of contents is vital.

□ A person (or more than one) is needed to both supply the prepared cartons to each table and to remove them to their designated station when packed.

■ *Securing the Objects using the Tray and Strapping Method*—in almost all cases, the most effective method of packing small works is to box them using an interior tray and strapping method as illustrated. It follows the principle of a 'box within a box', which is an immensely satisfying and safe technique.

The tray and strapping technique allows objects of disparate shapes to use a common size of box. A minimum clearance of at least 50 mm must be allowed around each object within the carton walls.

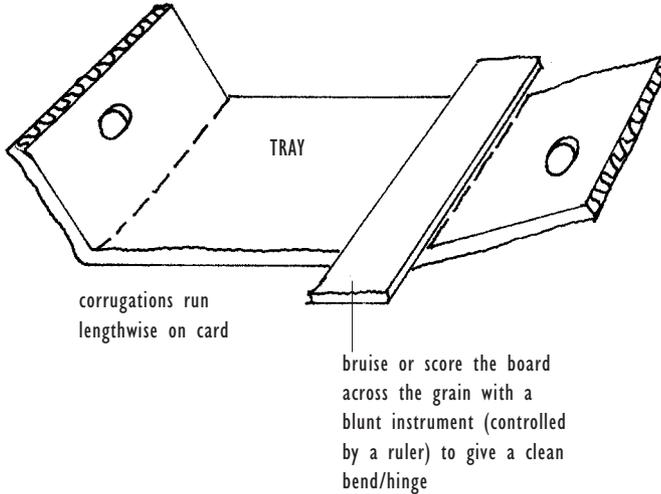
The tray is cut with corrugations running lengthwise as indicated in the diagram on page 56 and bruised for creasing across the grain for added strength. Allowance must be made for a 30–50 mm layer of foam lying below the tray and on the floor of the box.

The tray with folding walls should be an easy fit into the box—fingerholes cut into the sliding walls will facilitate both insertion and removal of the packed tray.

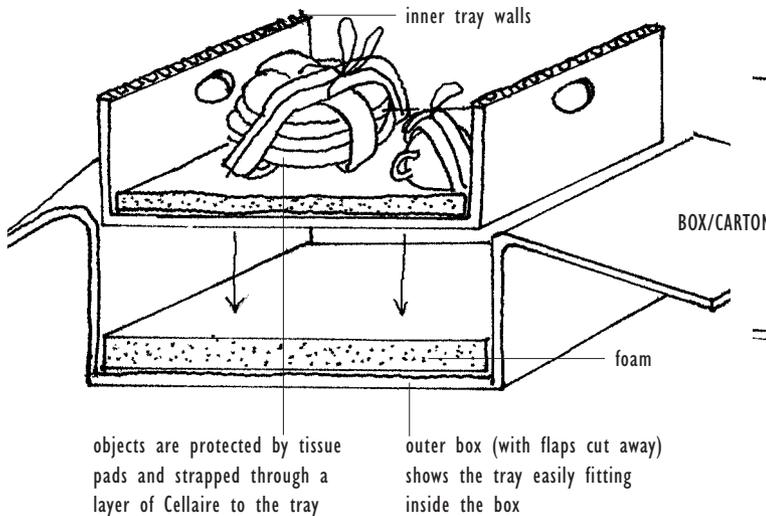
If the object has a fragile foot or rim, or other vulnerable parts, a series of soft supports will be needed to cushion these areas. It may require the cut seating/shaping of the artefact to stabilise it, so Evazote may be used to replace Cellaire as its floor.

Packing / Handling

making a tray



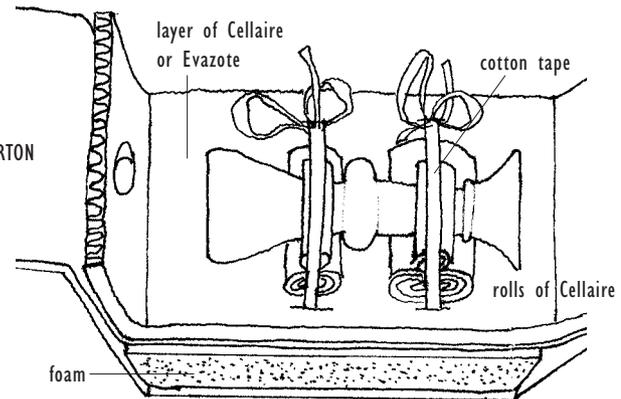
object secure to tray / tray fits into box



A cut through the protective layer of Cellaire and through the floor of the tray allows the cotton tape to pass underneath the tray and return to the upside for securing with a tie.

There are many advantages in using the tray and strapping method:

- It allows the packing process to be accomplished in comfort and safety independent of the carton or box, flat on the worktable, later to be inserted into the box when secured to the tray.
- It affords high visibility of the object and therefore immediate identification of its packing system by whoever has to unpack.
- It is an economic method which uses readily available materials. The tray is made of double corrugated board and is cut to fit the interior of the carton, allowing a pad of foam to lie below it on the floor of the carton. The side 'walls' of the tray should exactly reach the lid of the outer box so that when sealed, the 'walls' will prevent any upward movement of the packed contents.



Packing / Handling

Packing Large Sculptures and Pieces of Furniture

Not only small items can use this technique of strapping. It is common commercial practice in moving furniture and is a most effective method of transporting large pieces of furniture or sculpture.

A strong wooden pallet becomes the tray just described and this will offer a platform which can be padded as required with the strapping at vantage points along its length. The pallet, when strapped in the manner, can be crated as an entire package. The pallet is able to be moved easily and safely with a hydraulic forklift and can be custom made to accommodate whatever size of object is to be moved.

The traditional method of crating large sculpture is to secure the work at intervals, selecting and cradling those areas of the work which are the strongest for this treatment. This method demands high joinery skills. When handling and packing large sculptures or furniture:

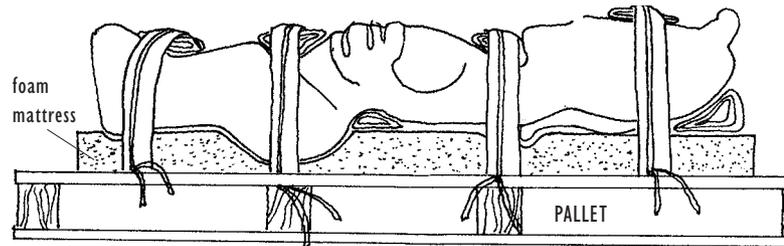
- Always use gloves.
- Always carry on a padded trolley or pallet.
- Do not move without sufficient manpower to satisfy safety precautions.
- Strap to resist movement when transporting anywhere within the building once it has been released from a crate or storage.
- Padding of Cellaire or equivalent must protect the work under the strapping; special care is needed for polychrome items or for fragile ornaments.

Packing Framed and Glazed Works on Paper and Photographs

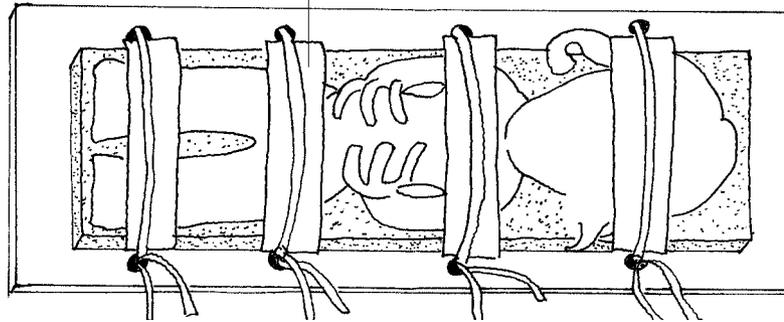
If framed works are being toured in an exhibition, it is advisable to use standard-sized frames. The recommended moulding for these is strong and designed to withstand the rigours of frequent handling and travelling. The frames are designed to fit easily into a slotted crate, riding on the flat edge as seen in the diagram.

Single works can be wrapped in bubblewrap and thick corrugated card for shorter journeys or if crating is not a viable option.

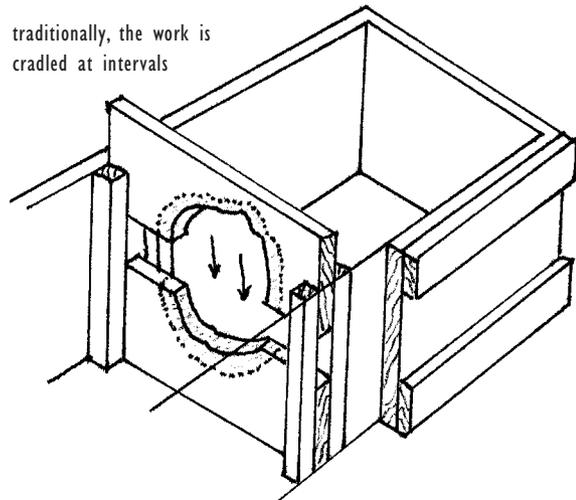
packing large works



padded protection of all surfaces to be strapped



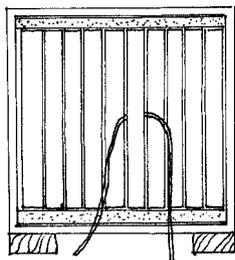
traditionally, the work is cradled at intervals



Packing / Handling

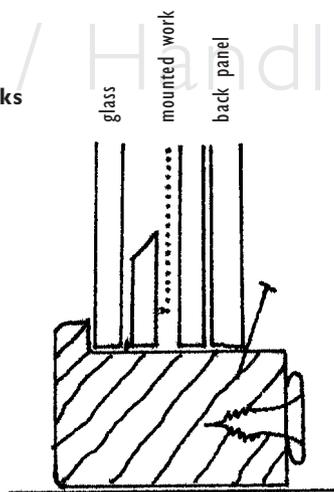
packing framed works

Each work is carried in its normal hanging position



A SIDE-OPENING CRATE

- frames are interleaved with corrugated card
- a central pulling device helps when extracting the first frame
- a foam layer top and bottom damps vibration



In either case, the entire surface of glass must be taped to the edge of the frame at approximately 50 mm intervals, forming a grid. Do not allow the tape to touch the frame where there is any surface gilding or pigment. If Perspex is used, a label must be fixed to the back-board to warn against using tape.

All hook eyes must be removed before packing; even flat hanging devices may scratch another frame. Always interleave any stacked frames waiting to be processed.

Packing Unframed Works on Paper

■ *Mounted Works*—acid-free tissue should be inserted underneath the window board and the mounted work wrapped with acid-free tissue. Two pieces of thick corrugated card are used in front and behind the work, securely taped around the edges.

■ *Unmounted Works*—works on paper should never be rolled for transportation. This may cause irreparable damage. The work should be placed between two sheets of acid-free board, a backing board or 'tray' and a cover board. These should be cut to the same size and be large enough to overlap the work by about 75 mm on all sides.

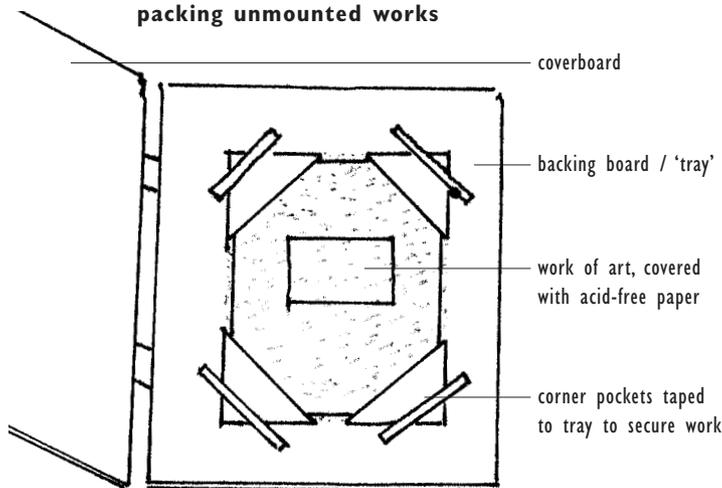
The work should be covered with a sheet of acid-free paper cut to the same dimensions as the work and held in position with corners of acid-free paper taped to the tray. The tray and the cover should then be taped together. If a number of works are packed together, each work should have its own tray.

When a work has a raised surface, the edge of the tray should be built up to prevent its being pressed between the boards.

■ *Outer Packaging*—additional boards should be placed on either side of the package to protect it from being punctured and to keep it rigid. It can then be wrapped in strong brown paper or corrugated card. It may be advisable to include a waterproof layer in the packaging such as bubblewrap or plastic.

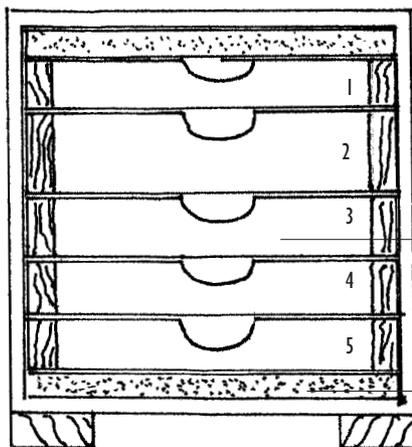
The package should be labelled with details of the contents and how to release them. Instructions on the

packing unmounted works



Packing / Handling

packing paintings with a rigid support

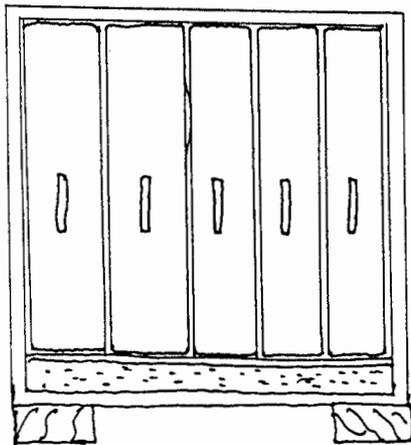


a side-loading crate (the depth of drawer or tray is determined by the safe clearance of the packed frame inside): drawers are removed from the top

each drawer runs off the lower carcass: a wide side wall ensures ease of movement

a foam base and lid to dampen vibration

packing paintings on canvas and wooden stretcher



if funds do not allow transport framing for individual works, individual boxing of each painting can provide a good alternative: boxes then slide into a side-loading crate

care of the package should be included, for example 'this way up', 'keep under cover', 'fragile' or 'glass'.

Packing Paintings With a Rigid Support—Board or Wooden Panel

If the frames have a variety of moulding and sizes then the method of strapping to a uniform size of shallow tray is a safe solution. This method can be used to pack glazed works for the same reason, as well as works on paper that have been 'floated' in their mounts (where the edge of the work is visible and it is more likely to move around during transportation). But it is not recommended for paintings on canvas and stretchers because of the flexibility of the support.

Packing Stretched Paintings on Canvas

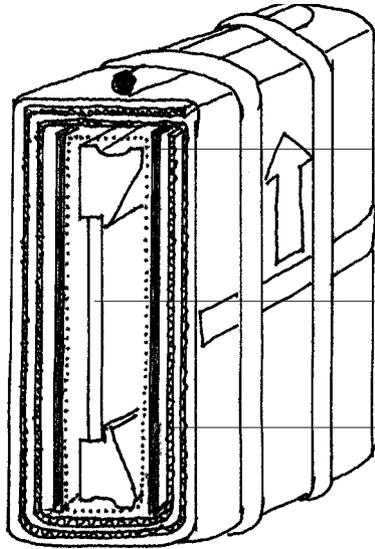
Ideally, when transporting an exhibition of paintings of different dimensions and frame mouldings, the paintings should be inserted in travelling frames which will accommodate a variation of size and depth. These can then be fitted in their correct *vertical* position into a custom-made crate.

Because the canvas is very flexible it is preferable to keep easel paintings in their normal hanging position to avoid any stress on the paint surface. Individual works can also be packed in travelling frames, particularly if they are unframed or have delicate surfaces. Otherwise it is possible to pack them into a crate with compact foam (Evazote, Ethafoam or polyurethane foam) holding the frame firmly in position. Nothing should touch the painting itself.

There should be no loose parts in the assembly of picture and frame. Any heavy wire, chains and hooks on the reverse of the painting should be removed. If a painting is glazed, the glass should be taped with masking tape from edge to edge. The tape should cover much of the glass and run both horizontally and vertically. Avoid tacks or nails during packing. Box tops should be attached with screws to avoid shock, vibration and accidents.

Packing / Handling

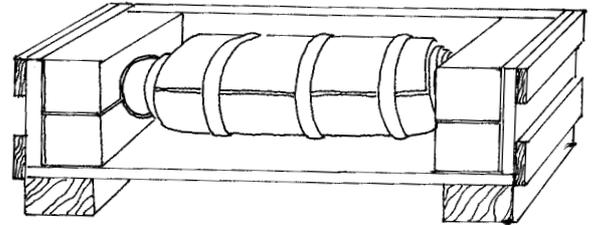
packing paintings for short journeys



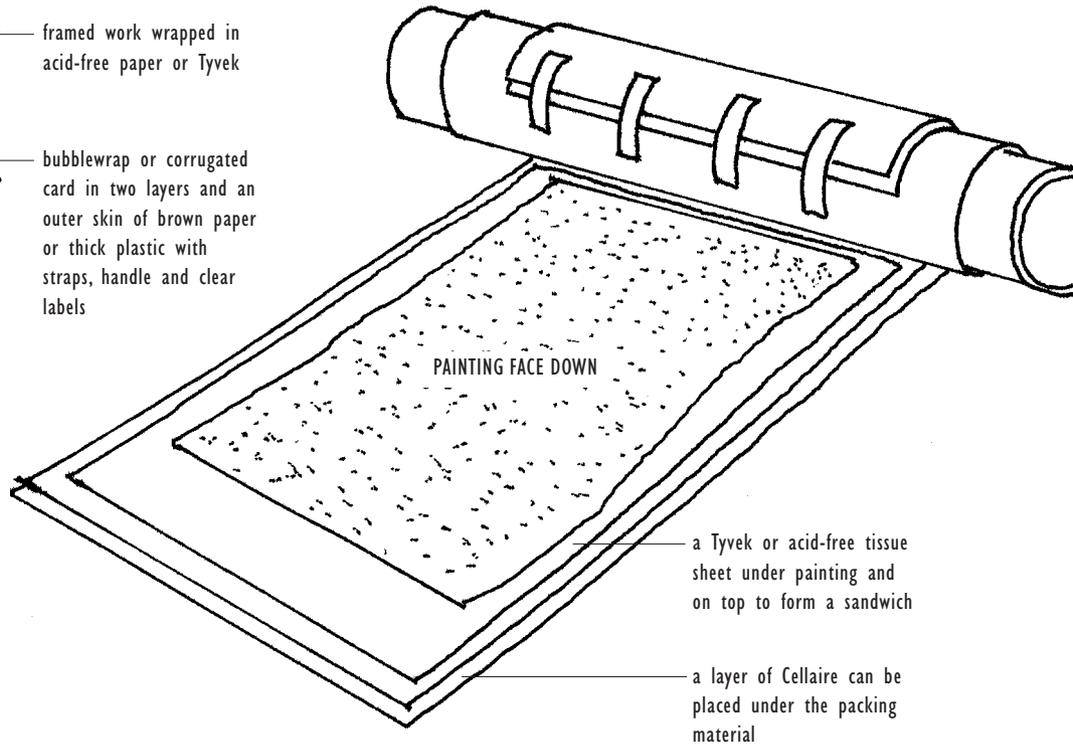
cardboard or hardboard sheets to prevent puncture damage

framed work wrapped in acid-free paper or Tyvek

bubblewrap or corrugated card in two layers and an outer skin of brown paper or thick plastic with straps, handle and clear labels



packing unstretched canvases by rolling



a Tyvek or acid-free tissue sheet under painting and on top to form a sandwich

a layer of Cellaire can be placed under the packing material

Packing / Handling

If the picture has to travel only a short distance, it is possible to avoid crating by soft wrapping. This involves wrapping it in clean tissue or Tyvek, cutting two boards (eg corrugated cardboard) that are the same outside dimensions as the frame and placing them on either side of the painting, and wrapping the whole package in bubblewrap. Extra padding (eg Evazote) may be wrapped around an ornate frame before the cardboard layer. Labels should be attached to the exterior.

Packing Unstretched Canvases

These works are invariably large and extremely vulnerable. Ideally, they should be carried flat and supported by a tray. This would have to be the method used if there are collage elements, low relief areas or areas of heavy paint (impasto).

As sliding trays or drawers are in common use for the storage of vulnerable textiles, it would be possible to use these same custom-made drawers within a crate for transporting works on exhibition. This sliding tray/drawer is a variation of the system used in packing small items in the

decorative arts and for transporting framed, glazed works with fragile frames, as described previously. The side-opening crate is virtually a chest of drawers with each drawer supporting another. Strapping over layers of acid-free material would restrict any movement.

Rolling a loose canvas is a last option; the paint surface must be thin and flexible if this method of packing is used. The same method can apply for tapestry and tapa cloth. The roll should measure at least 400 mm in diameter and should be covered with plastic followed by acid-free tissue or Tyvek to protect the artwork from any dirt, acidity or other undesirable materials in the cylinder. The work is rolled with acid-free tissue or Tyvek on both sides.

The length of the cylinder must be 200 mm greater than the width of the work to be rolled so that a clear 100 mm at each end of the rolled work can be supported on shaped blocks and therefore free of the floor.

The work must always be packed face down so that the paint layer is not subjected to a concertina action when rolled.

Suppliers

Suppliers of Conservation Materials

*Boards, papers, tapes and tissues
(suppliers of Archivart products)*



□ Carter Holt Harvey Distributors
11 branches nationwide

Auckland Office: 21 Saleyards Road
PO Box 22225, Otahuhu, Auckland
ph 09 259 0500, fax 09 259 0527

Wellington Office: PO Box 999, Wellington
ph 04 387 8313, fax 04 387 8812

Christchurch Office: PO Box 22506,
305 Cashel Street, Christchurch
ph 03 379 3550, fax 03 379 2219

Dunedin Office: PO Box 2078, South Dunedin
ph 03 445 6124, fax 03 455 5690

Archivart Products:

Barrier Paper

For temporary isolation from acidic materials.

Blotting paper

Storage boxes

Two-piece construction made from Multi-use board.
Suitable for the storage of prints and photographs.

Archival tissue

Archivart tissue—sometimes known as cigarette paper.
Suitable for wrapping artefacts.

Unbuffered tissue—a long-fibred tissue similar to
Japanese papers, semi transparent. Suitable for photo-
graphic storage.

Linen tapes

Acid-free—suitable for hinging mounts.

Archival paste

Methyl cellulose paste powder—neutral pH. Suitable
for hinging.

Mylar film

Polyester film. Inert. Useful for encapsulation and as a
barrier against moisture, acid and alkaline migration,
and dust.

Conservation board

Made from chemical pulp, acid-free and buffered.
Suitable for mounting of artworks.

Suppliers

Museum board

Ragboard, made from 100% cotton fibre. Superior quality to Conservation board. Suitable for mounting of artworks.

Library board

Acid-free with high alkaline reserve. Suitable for making folders, boxes and wallets.

Multi-use board

Acid-free and buffered corrugated board. Available in single wall = 3.175 mm and double wall = 6.350 mm thicknesses, in grey and white. Suitable for backing boards and for making boxes.

Specialist supplier (tapes, adhesives, tissues, boards, boxes, photographic storage, etc)

□ Conservation Supplies
Jack Fry. PO Box 54024, Mana, Porirua
ph 04 568 2062, fax 04 566 8902

Boards, papers, and tapes

□ Websters
25 King St, Newtown, Wellington
PO Box 6467, Wellington
ph 04 385 4136, fax 04 385 4138

33 Leslie Ave, Morningside, Auckland
ph 09 846 3971, fax 09 846 2976

Cotton gloves, tapes, boxes, negative and slide holders

□ Raeco
1 Sir William Ave, East Tamaki, Auckland
PO Box 51150, Pakuranga
ph 0800 800 791, fax 0800 800 235

Acid-free photocopy paper and cardboard boxes

□ Paper Magic Ltd
Lynn Sayers

29–33 Fitzherbet Street, Petone
PO Box 38133, Petone
ph 04 568 5534, fax 04 568 5538

Boards, papers, tapes and framing materials

□ Larson Juhl
PO Box 7081, Sydenham, Christchurch
144 Carlyle St, Sydenham, Christchurch
ph 03 366 2320, fax 0800 665 666

8 Francis Plc, Te Aro, Wellington
ph 04 385 7057

Auckland ph 360 8228 (redirected to Christchurch)

Framing materials and equipment

□ Tayles
Framers Supply Depot Ltd
5A/153 Stoddard Rd, Mt Roskill, Auckland
ph/fax 09 620 5476

Marine cleats JC#1

□ Sealine Marine Ltd
58 Frost Road, Mt Roskill, Auckland
PO Box 27202, Mt Roskill, Auckland
ph 09 620 7109, fax 09 620 7086

Photographic Storage

Secol polyester enclosures

□ T A Macalister Ltd
Private Bag 92146, Auckland
ph 09 303 4334, fax 09 309 6502

PO Box 1756, Wellington
(6 Cambridge Terrace)
ph 04 384 8730, fax 04 384 8498

Private Bag 4734, Christchurch
(12A/75 Peterborough Street)
ph 03 366 1530, fax 03 366 1356

Suppliers

DW polyethylene enclosures

- Lacklands Photographic Ltd
PO Box 56036, Auckland 3
ph 09 630 0753, fax 09 638 8421

Vue-all polyethylene film and print enclosures

- Radiographic Supplies
1/97 Sawyers Arms Road, Papanui, Christchurch
PO Box 5325, Papanui, Christchurch
ph 03 352 0480 or 0800 737 337, fax 03 352 0482

Miscellaneous Conservation

Dacron

- John Rainger Textiles
30 Mackelvie St, Grey Lynn, Auckland
PO Box 8496, Symonds St, Auckland
ph 09 360 1106, fax 09 360 2236
25 metre minimum purchase

Dacron

- Aekmead Trimmings
55 Sydney St, Petone
ph 04 568 5822, fax 04 568 5820

Dacron, minimum purchase one roll approx \$100; meterage depends on weight

- Ellis Fibre Ltd
152 Kaikorai Valley Rd, Dunedin
PO Box 7031, Dunedin
ph 03 476 4221

UV films

- Dial a Tint (agent for High
Performance Films, Australia)
PO Box 97920, South Auckland Mail Centre
26 Walmsley Road, Otahuhu, Auckland
ph 09 268 2588, fax 09 268 4141

UV and heat-absorbing films, security films

- Tinting Specialists
PO Box 9276, Te Aro, Wellington
ph 04 384 9305

Tyvek

- Fabri-cell
PO Box 97047, Wiri
24 Dalgety Drive, Wiri, Auckland
ph 09 266 4924, fax 09 266 4929

Cellaire foam

- E C Attwood
cnr St Georges Bay and Cleveland Rds,
Parnell, Auckland
PO Box 37568 Parnell, Auckland
ph 09 379 4125, fax 09 377 7589

Evaazote (EV50), Plastazote, Ethafoam, polyurethane foam

- Dunlop Flexible Foams Ltd
83-87 Harris Rd, Greenmount Estate, East Tamaki
PO Box 58136, Greenmount, Auckland
ph 09 274 5789, fax 09 274 4721

Cardboard tubes

- Sonoco New Zealand Ltd
3 Hickory Ave, Henderson, Auckland
ph 09 836 3009, fax 09 838 8648

Formatubes, polybags, packing materials

- Carter Holt Harvey Distributors
(see page 62)

Mylar, Melinex

- Plastic Material Supplies
93 Nelson St, Petone
PO Box 3237, Petone
ph 04 568 6816, fax 04 568 6899

Suppliers

Velcro and cotton tape

□ Foote Bros
43 Normanby Rd, Mt Eden
ph 09 623 4483, fax 09 623 4229

Paraloid B72 Acrylic Resin

□ Rohm and Haas
16 Beach Rd, Otahuhu, Auckland
PO Box 22220, Otahuhu, Auckland
ph 09 276 7154, fax 09 276 5518
Lois McGaffan

Methyl cellulose powder (BDH 292171)

(also supplied by Archivart and Tayles)
□ Labsupply Pierce
127 Sunnybrae Rd, Glenfield, Auckland
ph 09 4435867, fax 09 444 7314

0800 734 100 goes to both Christchurch and Auckland

11B Sheffield Cres, Bishopdale, Christchurch
ph 03 358 7410, fax 03 358 9598

Acid-free double-sided tapes

□ 3M New Zealand
Murray Rundal
PO Box 33246, Auckland
direct line 09 443 9025, main ph 09 444 4760

Nescher Filmoplast P90 and conservation supplies

□ Kents Framers Ltd
10A Ruskin St, Parnell, Auckland
ph 09 309 3821

Silica gel

□ D R Johnston
Greg Daniels
PO Box 62575, Central Park, Penrose
fax 09 525 5545, ph 09 525 5525, 025 394 575
now agents for W R Grace (NZ) Ltd

Glass mirror plates, brass (38 mm)

□ Glassecorp Ltd
7 Piermark Drive, Albany, Auckland
ph 09 415 6338

Specialist Services

Caution Art

□ Ian Bergquist
3 Mollyhawk Place, Birkenhead, Auckland
09 480 3012 workshop, 09 418 4841 ph/fax
Display design and installation; specialist fabrication;
security, storage, crating and shipping; collections
management and environment monitoring; lighting
design and fibre optics installation

Practical Studio Supplies Ltd

□ Cyril Wright
30 St Benedicts St, Newton, Auckland
PO Box 8966, Symonds St
fax 09 302 2312, ph 09 309 3769
Art exhibition coordination, installation, packaging and
transportation, storage, Turnbuckle stretchers

Exhibition Services

□ Mark Roach
32 Volga St, Wellington
ph/fax 04 383 5091
e-mail roach-culy@xtra.co.nz
Installation, packing, transport, registration,
consultancy

City Art

□ David Trerise
96 Disraeli Street, Christchurch
PO Box 7291, Christchurch 8035
ph/fax 03 365 3811
Artist stretchers, crates, packing and handling, storage
boxes, solander boxes

Suppliers

Manfred Frank Ltd

□ Manfred Frank, Richard Wolfe
PO Box 1775, Palmerston North
ph 06 354 2851, fax 06 354 5761
Design office ph 09 376 1067
Museum display case design and construction

Environmental Monitoring

Supply a variety of temperature, humidity, lux and UV meters

□ Salmond Smith Biolab Ltd
Bill McSweeney
39 Woodside Ave, Northcote, Auckland
ph 09 418 3039, fax 09 480 3430

Supply a variety of temperature, humidity, lux and UV meters

□ Scott Technical Instruments Ltd
14 Brandon St, Frankton, Hamilton
ph 07 847 0646, fax 07 847 0647

Hygrometer and thermohygrograph, psychrometers, lux meters

□ Met Instruments Ltd
107 Aro St, Wellington
PO Box 9254, Wellington
ph 04 384 7683, fax 04 384 7662

Trend data logging system

□ Axiom Data Logging Systems
Alan Jaffe
142 Coates Ave, Orakei, Auckland
ph/fax 09 521 0540
only supplier in New Zealand

Whirling hygrometer/whirling psychrometer

□ Watson Victor
616–618 Great South Rd, Ellerslie, Auckland
PO Box 1216, Auckland
ph 09 579 3039

4 Adelaide Rd, Wellington
PO Box 1180, Wellington
ph 04 385 7699, fax 04 384 4651

Unit 4 Petersborough Lane, 75 Petersborough Rd,
Christchurch

PO Box 706, Christchurch
ph 03 366 9282

Hair hygrometer

□ Teltherm Industries (NZ) Ltd
47 Normanby Rd, Mt Eden, Auckland
PO Box 52163, Kingsland, Auckland
ph 09 630 9573, fax 09 630 9528

Gossen Panlux electronic luxmeter

□ Lacklands Photographic Ltd
48 George St, PO Box 56036, Mt Eden, Auckland
ph 09 630 0753, fax 09 638 8421

Reading List

Most of the following titles would be available on special order from good bookshops, from the author, publisher, or through the Internet.

General

COOL (COnservation On Line)

<http://palimpsest.stanford.edu/>

Conservation and Restoration for Small Museums, 1981, Western Australian Museum, Francis Street, Perth, Western Australia 6000

Canadian Conservation Institute Notes and Technical Bulletins, Canadian Conservation Institute, 1030 Innes Road, Ottawa, Canada K1A 0M8

Bachmann, K., (ed.), *Conservation Concerns, A Guide for Collectors and Curators*, 1992, Smithsonian Institution Press, Washington D.C.

Fact Sheet, Conservation Services, National Library of New Zealand, PO Box 1467, Wellington

MacLeish, A. Bruce, *The Care of Antiques and Historical Collections*, second edition 1985, American Association for State and Local History, 708 Berry Road, Nashville, Tennessee 37204, USA

Sandwith, H. and Stanton, F., *The National Trust Manual of Housekeeping*, 1984, Penguin Books; 1991, Viking in association with the National Trust, London, England

Shelley, Marjorie, *The Care and Handling of Art Objects: Practices in the Metropolitan Museum of Art*, 1987, The Metropolitan Museum of Art, New York

Disaster Planning

Emergency Procedures, a practical guide for New Zealand Museums, Te Papa National Services, technical bulletin issue 2

Redefining Disasters: a decade of counter disaster planning. Papers submitted by speakers 20–22 September 1995, State Library of New South Wales ISBN 0–7310–6600–6

The J. Paul Getty Museum Emergency Planning Handbook, 1988, The J. Paul Getty Museum, PO Box 2112. Santa Monica, CA, USA

Fortson, J. *Disaster Planning and Recovery: A How-To-Do-It Manual for Librarians and Archivists*, no. 21, Neal-Schuman Publishers Inc

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<http://palimpsest.stanford.edu/bytopic/disasters/>

Environment

Preventive Conservation: Museum Collections and their Environment, 1990, 1994, workshop notes, Getty Conservation Institute

Thomson, G., *The Museum Environment*, 1978, 1986, Butterworths & Co Ltd, PO Box 472, Wellington, ph 04 385 1479 or 0800 800 986, fax 04 385 1598. ISBN 0–408–01536–5

Packing

Mecklenburg, M.F., (ed.), *Art in Transit: Studies in the Transport of Paintings*, conference preprints 1991, National Gallery of Art, Washington

Reading List

- Stolow, N., *Conservation Standards for Works of Art in Transit and on Exhibition*, 1979, Unesco Publication Orders, Government Printing Office Bookshop, Cubacade Trade Centre, Mulgrave Street, Private Bag, Wellington
- Taylor, M., *A Manual for the Handling and Packaging of Museum Objects*, Art Galleries and Museums Association of New Zealand, c/- Museum of New Zealand, PO Box 467, Wellington

Ceramics

- Buys, S., and Oakley, V., *The Conservation and Restoration of Ceramics*, 1993, Butterworth-Heinemann

Paintings

- Byrne, A., *Conserving Paintings: Basic Technical Information for Contemporary Artists*, 1995, Australian Council for the Arts, Craftsman House, Australia

Paper

- Clapp, Anne F., *Curatorial Care of Works of Art on Paper*, third revised edition, 1987, Nick Lyons Books, New York
- Ellis, Margaret Holbein, *The Care of Prints and Drawings*, 1987, American Association for State and Local History, Nashville

Books and Archive Materials

- Book cradle design—Greenfield, Jane, *Books, Their Care and Repair*, 1983, The H.W. Wilson Company, New York.
- Book wrappers and boxes—*Boxes for the Protection of Books: Their Design and Construction*, Library of Congress, Preservation Directorate (available National Library, Wellington)
- Book shoes—*Abbey Newsletter*, April 1988 v.12 ISSN 0276-8291
- Ogden, Shereley, (ed.), *Preservation of Library and*

Archive Materials: A Manual, 1992, North East Document Conservation Centre, Andover, Mass, USA

- Smith, J., Vial, T., and Wallace, L., *The Care and Storage of Archives and Manuscripts*, updated 1997, Canterbury Museum, Rolleston Ave, Christchurch 8001

Sound and Video Recordings

- Kodak Digital Science, *Permanence, Care and Handling of CDs*, January 1997 (<http://www.kodak.com/daiHome/techInfo/permanence.shtml>)
- St-Laurent, Gilles, *The Care and Handling of Recorded Sound Materials*, National Library of Canada, updated January 1996 (<http://palimpsest.stanford.edu/byauth/st-laurent/care.html>)
- Van Bogart, John, *Recovery of Damaged Magnetic Tape and Optical Disk Media*, NML, September 1995 (<http://www.nml.org/Publications/Presentations/DisasterRecovery/>)
- Ward, Alan, *A Manual of Sound Archive Administration*, 1990, Gower Publishing Company Limited
- McWilliams, Jerry, *The Preservation and Restoration of Sound Recordings*, 1979, American Association for State and Local History, Nashville

Pest Control

- Scott, R. R., (ed.), *New Zealand Pest and Beneficial Insects*, 1984, Lincoln University of Agriculture, Canterbury
- Clarke, O.A., 'Keeping Bugs Away: Pest Control for Small Museums', revised June 1996, *NZ Museums Journal*, vol.26 no.2, pp 27-32
- Clarke, O.A., *Pest Management at the Museum of New Zealand, Te Papa Tongarewa*, revised July 1997, Museum of New Zealand, Te Papa Tongarewa, PO Box 467, Wellington

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Pest Control in Museums: A workshop emphasising non-toxic fumigation techniques, March 1996, workshop notes, Materials Conservation Division, Australian Museum, Sydney, Australia
Zyberman, L.A., (ed.) and Schrock, J.R., (assist. ed.), *A Guide to Museum Pest Control*, 1988, AIC and Association of Systematics Collections, Washington, USA

Photographs

Eastman Kodak Company, *Conservation of Photographs*, 1985, Rochester, New York. Available from Radiographic Supplies, PO Box 5325, Papanui, Christchurch
Keefe, Lawrence E., and Inch, Dennis, *The Life of a Photograph: Archival Processing, Matting, Framing, Storage*, 1984, Focal Press, Boston and London
Reilly, James, *Care and Identification of Nineteenth Century Photographic Prints*, 1986, Eastman Kodak Company, Rochester, New York. Available from Radiographic Supplies, PO Box 5325, Papanui, Christchurch
Rempel, Siegfried, *The Care of Photographs*, 1987, Lyons & Burford Publishers, New York
Ritzenthaler, Mary Lynn et al, *Administration of Photographic Collections*, 1984, Society of American Archivists, Chicago

Wilhelm, Henry, with Brower, Carol, *The Permanence and Care of Color Photographs: Traditional and Digital Color Prints, Color Negatives, Slides and Motion Pictures*, 1993, Preservation Publishing Company, Grinnell, Iowa

Textiles and Basketry

Bachmann, K., (ed.), *Conservation Concerns, A Guide for Collectors and Curators*, 1992, Smithsonian Institution Press, Washington D.C.
Carson, V., 'Preventative Textile Conservation'. In *AGMANZ Journal* 20.4 Supplement, pp 1–8, AGMANZ, Wellington.
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